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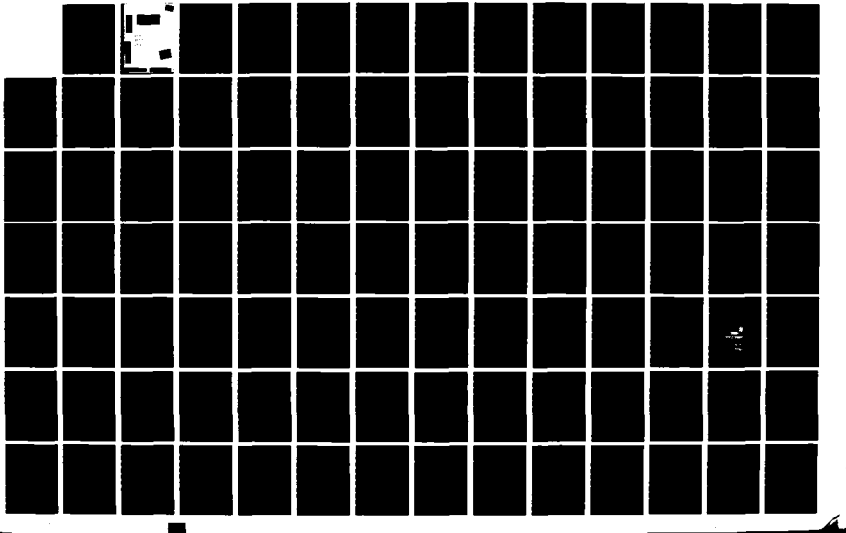

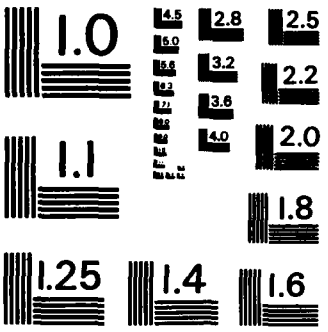

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FACILITIES CAPITAL AS A FACTOR IN CONTRACT PRICING

May 1985

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Executive Summary

FACILITIES CAPITAL AS A FACTOR IN CONTRACT PRICING

In 1976, the Department of Defense (DoD) revised its contract pricing policies with the intent of increasing incentives for investment in facilities. Until then, contract pricing had been based almost entirely on expected costs, without regard to a contractor's use of facilities capital. With pricing based on costs alone, investments that reduced cost also reduced profitability, a penalty that made such investments unattractive.

Since 1976, however, DoD contract pricing has taken facilities capital into consideration as a determinant of profit in the weighted guidelines profit policy; moreover, an amount based on facilities capital is recognized as an allowable cost (Cost Accounting Standard 414). These changes were intended to encourage investment in new facilities by reducing the penalty for cost reduction. We have evaluated the effectiveness of the policy changes.

We find that, since 1976, the increase in defense contractors' use of facilities capital has been substantial -- more, in fact, than the significant growth in defense business over this period. The amount of facilities capital used in relation to the amount of defense business increased by about 4 percent a year, indicating that the new pricing policies do encourage investment in facilities capital. But manufacturers of durable goods economy-wide increased their relative use of facilities capital by about 7 percent a year, showing that defense contractors still lag behind. Lack of full implementation of the new pricing policies may to some extent account for this lag. Although we find substantial compliance by DoD contracting personnel with the new policies, negotiators frequently offset profit on facilities capital by

reducing profit on other factors. As a result, the revised policy is not as effective as intended.

We evaluated alternative types of policies to encourage cost reductions. By further lowering the importance of cost and raising the importance of capital in determining profit, DoD can increase a contractor's incentive to invest in facilities capital. However, even a profit policy based entirely on capital would not necessarily motivate investment in the most productive facilities. There are at least two ways of encouraging investment in cost-reducing facilities. One is to change the profit structure to apply different profit rates to investments that yield different benefits to DoD. The second is for DoD to share investment-related cost savings with the contractor that makes such investments.

In a separate analysis, we examined whether it is necessary to offer an additional return to compensate for any additional uncertainty associated with DoD work. We find that defense firms incur no more financial risk than other firms in similar product lines.

Finally, The Conference Board, under subcontract, assessed the attitudes of the financial community toward defense contractors and found that it perceives them as strong and healthy. Reasons cited for this financial strength are increases in sales, pricing policy changes such as more generous progress payments, and more liberal tax treatment of investment.

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APPENDIX

1. INTRODUCTION AND SUMMARY

In 1976 the Department of Defense (DoD) introduced facilities capital as a determinant of contract price, to encourage greater efficiency through contractor investment in modern facilities. The Defense Financial and Investment Review (DFAIR) is examining contract pricing policies. We studied a number of topics related to whether the new emphasis on facilities capital in contract pricing has had the results expected. These questions were investigated:

- Is the weighted guidelines method of profit determination followed in contract pricing, and does facilities capital play the role intended (Chapter 2)?
- Have contractors increased investment in response to the introduction of facilities capital in contract pricing (Chapter 3)?
- Is there an ideal structure for contract pricing that rewards contractors fairly while encouraging efficiency and cost effectiveness (Chapter 4)?
- Are there differences in financial returns and risk between commercial and DoD work (Chapter 5)?

POLICY BACKGROUND

In 1976 and again in 1980, DoD revised its contract pricing policies to increase investment incentives. These revisions followed DoD's "Profit '76" study, which concluded that defense contractors used only about 40 percent as much facilities capital per dollar of sales as U.S. manufacturers of durable goods generally. The study also concluded that ". . . there are probably productivity gains that could be made if defense contractors increased their investment."[1]

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[1] "Profit '76" Briefing Chart, p. II-36.

Before October 1976, when the revised policies took effect,[2] DoD's contract pricing policies included little direct recognition of facilities capital. Negotiated contract price was based on expected cost and profit. Profit, in turn, was determined as a percentage of expected cost. If two contractors incurred equal costs, the contractor with more capital invested in facilities received no more profit than the one with less. In fact, if the contractor with more facilities capital was expected to incur lower costs as a result of the facilities investments, the contractor might well have received a lower price (both cost and profit). DoD concluded that the policy of basing prices entirely on expected costs served to discourage the acquisition of modern facilities.[3]

Recognizing the deficiencies inherent in those pricing policies, DoD made a substantial change in 1976 by recognizing facilities capital as a determinant of profit. This change appeared in the weighted guidelines formula for determining DoD's profit objective. Cost Accounting Standard (CAS) 414, which recognizes as a cost an imputed "cost of money" based on the amount of facilities capital, was also introduced in 1976.

The penalty embodied in the old policy when investment in facilities capital served to reduce both cost and profit was to be moderated or offset by payments for both profit and cost of money, based on the amount of facilities capital employed. Profit on facilities capital was to be paid at a rate of 6 to 10 percent; cost of money was to be paid at a floating market rate determined by the U.S. Treasury.

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[2]Pricing changes were contained in Defense Procurement Circular (DPC) 76-3 and DPC 76-12.

[3]The only element in the pricing system that acts to offset this tendency somewhat is depreciation on facilities capital. New contractor investment implies higher depreciation (an allowable cost) and higher profit based on depreciation.

A second policy modification, in 1980, moved farther in the direction established in 1976 for production contracts. The profit rate assigned to facilities capital in the weighted guidelines profit formula was raised to a range of 16 to 20 percent. At the same time, the weighted guidelines applicable to contracts for research and development (R&D) and services reverted to the original, cost-based, method.

In the balance of this chapter, we summarize our research findings and conclusions. Later chapters present details of our analysis and findings for each of the subtasks described above.

ROLE OF FACILITIES CAPITAL IN DETERMINING PROFIT

The weighted guidelines apply varying profit rates to various resource categories. Because facilities capital represents only one such category and the various categories are additive under the weighted guidelines method, it is necessary to examine all categories to isolate the effect of facilities capital. The weighted guidelines also assign an element of profit on the basis of total cost, the rate varying with contract type. The variation in rate reflects differences in risk associated with different contract types.

If the weighted guidelines play a major role in determining profits, we expect profit rates to be higher than average when high-profit-bearing cost categories constitute a significant portion of costs, when fixed-price contracts are negotiated, and when large amounts of facilities capital are employed. Profit rates should be lower than average under the opposite circumstances: when low-profit-bearing costs are important, cost-reimbursement contracts are negotiated, and small amounts of facilities capital are employed.

We conclude that DoD negotiators are, in fact, applying the revised policy to manufacturing contracts. Facilities capital does affect the

determination of profit. But the revised policy is not as effective as intended, because the profit related to facilities capital is less than specified in the weighted guidelines policy. Negotiators offset profit on facilities capital by reducing profit on other weighted guidelines factors. Such informal offsets are made possible by the wide range of profit rates for the categories allowed in the weighted guidelines.

For R&D and service contracts, the weighted guidelines require that profit be reduced, dollar for dollar, by the amount of cost-of-money payments. The apparent offset for facilities capital cost of money in R&D and service contracts has been applied as intended, but the offset has not been fully effective. In contracts where cost of money is claimed, the total rate of negotiated profit and cost of money tends to exceed the rate of profit on contracts that do not include cost of money.

We also conclude that the weighted guidelines account for only half of the variability in profit rates found in our sample. Other, unknown, factors account for the remainder of the variation in observed profit rates.

One purpose of the revised weighted guidelines was to disperse profit outcomes more widely. Higher profit was to be awarded on contracts with above-average amounts of facilities capital employed. But the weighted guidelines permit enough flexibility to neutralize some of the intent of the policy change. If that intent is to be realized, the profit ranges now allowed should be narrowed.

FACILITIES CAPITAL INVESTMENTS BY DEFENSE CONTRACTORS

Analysis of the defense industry's response to the investment incentives of the revised pricing policies between 1978 and 1982 demonstrates clear evidence of a high rate of investment by defense contractors, defined as business segments doing the majority of their work for DoD. Investment was

measured by the remaining book value of facilities capital. During the period studied, this value grew about 20 percent a year for defense contractors, in contrast to about 13 percent a year for durable goods manufacturers generally.

Over the same period, business activity (measured by total cost) of defense contractors grew at an annual rate of about 16 percent; the comparable figure for durable goods manufacturers was about 6 percent.

This combination of rapid growth in facilities capital of about 20 percent a year and business base growth of about 16 percent a year led to an increase in the relative use of capital by the defense industry. The ratio of facilities capital to business base grew by about 4 percent a year.

The ratio of facilities capital to business base has increased among defense contractors, going from about $11 of facilities capital per $100 of costs to about $13. Over the same period, durable goods manufacturers increased their relative use of capital at a somewhat faster rate -- from about $23 of facilities capital per $100 of cost to about $29.

We also examined the type of assets acquired by defense contractors. In the five years after the DoD change in pricing policies, the most important categories of annual capital expenditures by defense segments were: machinery and equipment (35 percent), buildings (18 percent), data processing equipment (11 percent), and instruments (10 percent). A growing share of annual capital expenditures was devoted to buildings at the expense of machinery, equipment, and instruments.

Finally, there is evidence indicating higher-than-average growth in productivity in some sectors that can be clearly identified as defense-oriented. There is also an indication that the percentage of costs incurred for labor in DoD contracts is declining as contractors increase their use of facilities capital.

We conclude, on the basis of available evidence, that the behavior of the defense industry has been consistent with the intent of the policy changes of 1976 and 1980. But, because durable goods manufacturers in general have increased their relative use of capital at a greater rate than the defense industry, we conclude that the new pricing policies do not encourage use of facilities capital at commercial levels, though they have less of a discouraging effect than the old policies.

ALTERNATIVE CONTRACT PRICING POLICIES

Contract pricing policies have been investigated by means of a model that analyzes contractor cash flow resulting from new investment. Investments must provide contractors with a rate of return competitive with what they can earn on investments elsewhere. The model evaluates contractor return on the basis of discounted cash flow analysis -- the prevailing method by which industry makes investment decisions. The model incorporates the following elements of contract pricing: the profit component of contract price, depreciation accounting practices, and contract cost incentives. Alternative policies for contract pricing are evaluated on their ability to encourage contractor investments that reduce DoD's contract prices.

With the model, we have verified the widespread belief that the present profit component of contract pricing can discourage investments that would lead to substantial cost reductions for DoD. Investments that lower contractor costs erode the total cost base on which a substantial part of the contractor's profit is now determined. The present policy fails to distinguish among investments with different productivity gains. Pricing policy now rewards equivalent investments with the same depreciation, profit, and cost of money but penalizes the best type of investment, one that lowers contract costs and, therefore, profits.

3. FACILITIES CAPITAL INVESTMENTS BY DEFENSE CONTRACTORS

INTRODUCTION

This chapter describes the defense industry's response to the investment incentives of DoD's revised pricing policies. The revisions followed DoD's "Profit '76" study, which concluded that defense contractors employ only about 40 percent as much facilities capital per dollar of sales as U.S. manufacturers of durable goods generally. The study also concluded that ". . . there are probably productivity gains that could be made if defense contractors increased their investment."[1] We examined whether these policy changes accomplished their intended purpose of increasing contractor investment. We also examined any detectable evidence of the effects that such investment may have on the productivity of work performed for DoD.

MEASURING CONTRACTOR INVESTMENT

There are a number of alternative measures of contractor investment in facilities and alternative data sources to quantify these measures. We have concentrated our effort on the measure we judge to be preferred -- the ratio of facilities capital to business base.[2] Facilities capital is taken as a business segment's remaining book value of assets, while the associated business base is either total cost or sales. To evaluate the behavior of this ratio, we have compiled a primary data base and several alternative data bases.

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[1] "Profit '76" Briefing Chart, loc. cit.

[2] A common alternative measure, investment per dollar of costs or sales, can be misleading. Annual investment per dollar of sales may be high but may merely maintain the existing ratio of assets to sales if that ratio is historically high. Conversely, even a low ratio of investment per dollar of costs can imply rapid growth in the ratio of assets to costs if that ratio began at a low level.

The weighted guidelines are not the single determinant of profit; they account for only about half of the range of profit rates found in our sample. Other, unknown factors account for the remainder of the variation in observed profit rates.

One intent of the revised weighted guidelines was to create more widely dispersed profit outcomes. Higher profit was to be awarded to contracts with above-average amounts of facilities capital employed. But the weighted guidelines permit enough flexibility in implementation to neutralize some of the intent of the policy change. Accordingly, if that intent is to be carried out, the profit ranges now allowed by the weighted guidelines should be narrowed.

- Contract type is always a significant determinant of profit rates (botb the profit objective and the rates actually negotiated), with a relationship scaled in the direction called for in the profit policy. In manufacturing contracts, for example, firm-fixed-price awards had negotiated profit rates 4.9 percentage points higher than cost-plus-fixed-fee awards after all other contract differences were accounted for. Smaller differences depending on contract type were found for negotiated profit rates for R&D and service contracts.

- The profit objective is a reasonable predictor of the profit rate actually negotiated, if the contract type is known. However, profit objective and contract type explain, at most, 72 percent of the variability observed in negotiated profit rates for service contracts. Profit objective and contract type explain 70 percent of actual negotiated profit rates for manufacturing contracts and 50 percent for R&D contracts.

- The percentage of material acquisition in cost is a significant variable for both profit objectives and negotiated profit rates. Contracts with relatively high percentages of material acquisition costs have lower-than-average profit rates.

- The presence of special fees for productivity and independent development is always associated with higher profit objectives and negotiated profit rates.

CONCLUSIONS

We conclude that the introduction of facilities capital as a factor in determining profit has been implemented for manufacturing contracts. The effect that additional amounts of facilities capital have on profit, however, is less than is suggested by the weighted guidelines. Negotiators offset the intended effect of facilities capital by reducing profit on other weighted guidelines factors.

For R&D and service contracts, the weighted guidelines require that profit be reduced dollar for dollar for any cost of money paid. The apparent offset for facilities capital cost of money in R&D and service contracts has been applied as intended, but the offset has not been fully effective. In contracts where cost of money is claimed, the total rate of negotiated profit and cost of money tends to exceed the rate of profit on contracts that do not include cost of money.

amount of variability from contract to contract for each of the independent (explanatory) variables; standard deviations are either nearly as large as or larger than each variable's corresponding mean value. By contrast, all the profit-rate variables, both objective and negotiated, with and without cost of money, are clustered tightly around their mean values. Apparently, typical profit rates tend to be negotiated despite diversity of contract characteristics.

TABLE 2-4. CHARACTERISTICS OF VARIABLES USED IN ANALYSIS OF DD 1499 DATA BASE

(5,434 CONTRACTS)

	WEIGHTED GUIDELINES CATEGORY					
	MANUFACTURING		R&D		SERVICES	
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION
Dependent variables (profit rates):						
Profit objective (%)	11.2	2.8	8.0	2.1	8.4	1.7
Profit objective with COM (%)	12.6	3.5	9.1	2.0	8.9	1.7
Negotiated profit (%)	11.5	2.9	8.2	2.3	8.7	1.8
Negotiated profit with COM (%)	12.9	3.5	9.3	2.4	9.3	2.0
Independent variables (contract characteristics):						
Contract size-objective (millions $)	8.2	32.2	4.0	12.4	2.8	4.9
Contract size-negotiated (millions $)	8.5	33.8	4.1	13.2	2.8	5.1
Material acquisition (%)	32.9	23.8	20.3	22.4	8.0	16.6
Engineering - direct labor (%)	10.3	13.1	27.3	12.6	2.2	10.2
Engineering - overhead (%)	10.5	13.4	27.6	13.0	1.3	6.1
Manufacturing - direct labor (%)	9.4	9.1	1.5	4.5	0.1	0.9
Manufacturing - overhead (%)	15.6	14.8	2.0	5.2	< 0.1	0.3
Services - direct labor (%)	0.1	2.0	0.2	2.1	37.4	16.0
Services - overhead (%)	0.1	1.5	0.2	2.4	28.0	13.6
Other costs (%)	8.3	12.6	9.5	12.9	11.9	14.2
G&A (%)	12.7	6.6	11.4	5.8	11.1	5.6
Facilities capital employed (%)	10.4	8.6	8.0	8.9	4.1	6.4
Special (productivity, independent development and other) (%)	14.4	18.1	10.2	11.1	9.5	7.8
Year dummies - D1 = 1981 (%)	28.4	45.1	43.5	49.6	37.8	48.5
D2 = 1982 (%)	38.8	48.7	48.8	50.0	51.4	50.0
Contract-type dummies - D3 = CPIF[1] (%)	6.4	24.5	11.9	32.3	2.2	14.7
D4 = FFP[2] (%)	71.1	45.3	15.6	36.3	32.1	46.7
D5 = FPI[3] (%)	8.5	27.9	6.8	25.2	2.1	14.2
Service dummies - D6 = Navy (%)	23.0	42.1	16.5	37.2	52.0	50.0
D7 = Air Force (%)	63.1	48.3	54.2	49.9	29.0	45.4
COM[4] dummy - D8 = COM[4] paid (%)	--	--	68.2	46.6	52.1	50.0

[1]Cost plus incentive fee.

[2]Firm fixed price.

[3]Fixed price incentive.

[4]Cost of money.

- The weighted guidelines method explains the Government's profit objective to a considerably greater extent than it explains the profit rate actually negotiated. In the case of negotiated profit, weighted guidelines account for 57 percent, 37 percent, and 47 percent, respectively, of the variation observed in profit rates for manufacturing, R&D, and service contracts. The explanatory power of the weighted guidelines for profit objectives as measured by R^2 was 77 percent, 64 percent, and 48 percent for each of these categories, respectively.

TABLE 2-3. THE EFFECTIVENESS OF WEIGHTED GUIDELINES FOR SERVICE CONTRACTS (677 CONTRACTS)

PROFIT OBJECTIVE PLUS COST OF MONEY			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT (PERCENTAGE)	t-VALUE
Intercept		.081	26.18[a]
Contract size		.195	1.96
Material acquisition		-.040	-10.64[a]
Service - direct labor		-.008	- 1.85
Other costs		-.020	- 4.94[a]
G&A		-.013	- 1.42
Special		.022	3.54[a]
Year dummies -	D1 = 1981	.001	0.63
	D2 = 1982	.003	1.72
Contract-type dummies -	D3 = CPIF[b]	.007	2.17[a]
	D4 = FFP[c]	.015	12.45[a]
	D5 = FPI[d]	.014	3.83[a]
Service dummies -	D6 = Navy	.003	1.99[a]
	D7 = Air Force	.008	5.11[a]
COM[e] dummy -	D8 = COM[e] paid	.009	8.94[a]
R^2 = .48			

NEGOTIATED PROFIT PLUS COST OF MONEY[f]			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT (PERCENTAGE)	t-VALUE
Intercept		.093	25.13[a]
Contract size		.142	1.24
Material acquisition		-.043	- 9.41[a]
Service - direct labor		-.021	- 4.21[a]
Other costs		-.016	- 3.14[a]
G&A		-.023	- 2.08[a]
Special		.017	2.35[a]
Year dummies -	D1 = 1981	.002	1.05
	D2 = 1982	.007	3.17[a]
Contract-type dummies -	D3 = CPIF[b]	.001	0.17
	D4 = FFP[c]	.016	10.54[a]
	D5 = FPI[d]	.015	3.60[a]
Service dummies -	D6 = Navy	-.008	- 5.02[a]
	D7 = Air Force	< .001	0.12
COM[e] dummy -	D8 = COM[e] paid	.015	11.85[a]
R^2 = .47			

NEGOTIATED PROFIT PLUS COST OF MONEY[f]			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT (PERCENTAGE)	t-VALUE
Intercept		.020	6.98[a]
Contract size		.044	0.54
Profit objective		.839	27.51[a]
Year dummies -	D1 = 1981	<-.001	- 0.08
	D2 = 1982	.002	1.58
Contract-type dummies -	D3 = CPIF[b]	-.005	- 1.89
	D4 = FFP[c]	.003	2.27[a]
	D5 = FPI[d]	.004	1.22
Service dummies -	D6 = Navy	-.011	- 9.31[a]
	D7 = Air Force	-.007	- 4.59[a]
COM[e] dummy -	D8 = COM[e] paid	.007	7.43[a]
R^2 = .72			

[a] Significant at 5-percent level.

[b] Cost plus incentive fee.

[c] Firm fixed price.

[d] Fixed price incentive.

[e] Cost of money.

[f] Cost categories used as explanatory variables are based on values used to determine the profit objective, because amounts actually negotiated are not reported.

TABLE 2-2. THE EFFECTIVENESS OF WEIGHTED GUIDELINES FOR R&D CONTRACTS (1,071 CONTRACTS)

PROFIT OBJECTIVE PLUS COST OF MONEY			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT	t-VALUE
Intercept		.085	22.87[a]
Contract size		.009	0.28
Material acquisition		-.037	-10.45[a]
Engineering - direct labor		.009	1.52
Manufacturing - direct labor		-.013	- 0.92
Manufacturing - overhead		-.014	- 1.14
Other costs		-.027	- 6.28[a]
G&A		-.003	- 0.43
Special		.030	8.67[a]
Year dummies -	D1 = 1981	-.004	- 2.55[a]
	D2 = 1982	-.004	- 2.50[a]
Contract-type dummies -	D3 = CPIF[b]	.010	7.74[a]
	D4 = FFP[c]	.030	26.02[a]
	D5 = FPI[d]	.035	21.86[a]
Service dummies -	D6 = Navy	.002	1.28
	D7 = Air Force	.001	1.04
COM[e] dummy -	D8 = COM[e] paid	.008	9.65[a]
R^2 = .64			

NEGOTIATED PROFIT PLUS COST OF MONEY[f]			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT	t-VALUE
Intercept		.083	14.09[a]
Contract size		-.007	- 0.16
Material acquisition		-.034	- 6.07[a]
Engineering - direct labor		-.007	0.71
Manufacturing - direct labor		-.005	- 0.22
Manufacturing - overhead		-.003	- 0.17
Other costs		-.023	- 3.46[a]
G&A		.012	- 1.05
Special		.034	6.19[a]
Year dummies -	D1 = 1981	-.001	- 0.26
	D2 = 1982	.002	- 0.65
Contract-type dummies -	D3 = CPIF[b]	.007	3.43[a]
	D4 = FFP[c]	.026	14.39[a]
	D5 = FPI[d]	.031	12.38[a]
Service dummies -	D6 = Navy	<-.001	- 0.01
	D7 = Air Force	-.002	- 1.28
COM[e] dummy -	D8 = COM[e] paid	.014	10.84[a]
R^2 = .37			

NEGOTIATED PROFIT PLUS COST OF MONEY[f]			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT	t-VALUE
Intercept		.015	4.18[a]
Contract size		-.025	- 0.62
Profit objective		.760	22.27[a]
Year dummies -	D1 = 1981	.003	1.25
	D2 = 1982	.005	2.30[a]
Contract-type dummies -	D3 = CPIF[b]	<-.001	- 0.11
	D4 = FFP[c]	.004	1.84
	D5 = FPI[d]	.005	2.09[a]
Service dummies -	D6 = Navy	-.001	- 0.78
	D7 = Air Force	-.003	- 2.10[a]
COM[e] dummy -	D8 = COM[e] paid	.009	7.37[a]
R^2 = .50			

[a]Significant at 5-percent level.

[b]Cost plus incentive fee.

[c]Firm fixed price.

[d]Fixed price incentive.

[e]Cost of money.

[f]Cost categories used as explanatory variables are based on values used to determine the profit objective, because amounts actually negotiated are not reported.

This offset policy was tested by the inclusion of a dummy variable, D8, which assumes a value of one when cost of money is paid and a value of zero otherwise. With perfect dollar-for-dollar offset, D8 should be statistically insignificant (i.e., zero). The following observations are derived from the regression results presented in Tables 2-2 and 2-3.

- When cost of money is paid on R&D and service contracts, profit plus cost of money is significantly higher than on otherwise similar contracts where cost of money is not paid. This implies that cost of money is not fully offset, despite requirements of the policy. R&D contracts with cost of money paid have a negotiated profit rate 1.4 percentage points higher than otherwise similar contracts without cost of money (see Table 2-2's coefficients for the cost-of-money dummy). For service contracts, Table 2-3 indicates a negotiated profit rate 1.5 percentage points higher when cost of money is paid.

- Profit objectives and negotiated rates for R&D and service contracts are related weakly to the weighted guidelines. The R^2 for profit objective is 0.64 for R&D contracts and 0.48 for service contracts. Negotiated profit rates have lower R^2's of 0.37 and 0.47 for R&D and services, respectively, indicating that the weighted guidelines factors account for only a small fraction of the variation observed in the sample of negotiated profit rates.

- Profit rates are lower than average in contracts where concentrations of material acquisition costs and "other costs" are higher. Fixed-price contracts carry a higher profit rate than cost-reimbursement contracts, but other factors called for in the weighted guidelines generally play no significant role in profit determination, as indicated by the insignificant "t"-values reported for each of the other weighted guidelines elements. Special factors, when present, tend to increase profit rates in a significant way.

All Contracts Using Weighted Guidelines

The findings in this section apply to all categories of contracts using the weighted guidelines (i.e., manufacturing, R&D, and services). They represent results found to hold throughout all of the regression results as reported in Tables 2-1, 2-2, and 2-3. The following results also draw upon information contained in Table 2-4.

- There is relatively little variability in profit rates, despite a great deal of variability in the cost makeup and other characteristics of individual contracts. Table 2-4 shows a great

determinant of profit objective or negotiated profit rates. After adjusting for all other factors, profit on contracts with relatively high amounts of engineering labor does not differ from profit on contracts with average or lower-than-average amounts of engineering labor.

- Contract type, cost makeup, Military Service, contract size, year, and facilities capital employed explain 77 percent of the variation in profit objective and 57 percent of the variation in negotiated profit rate. Factors other than those considered in the weighted guidelines play an important role in determining profit rates actually negotiated, as indicated by the R^2 value of 0.57 reported in Table 2-1.

- Profit objectives and negotiated profit rates increased slightly (about 1/2 of 1 percent) in 1981 and 1982 above 1980 after all other contract characteristics were adjusted for.

- Slight differences in profit objective by Military Service were found, but no significant differences were found for negotiated profit rates. The Air Force and Navy formed slightly higher profit objectives (0.4 percent and 0.3 percent, respectively) than the Army.

R&D and Service Contracts

Facilities capital is no longer a direct element of profit for R&D and service contracts. Facilities capital does, however, influence pricing through cost of money, which is analyzed here. For these contracts, facilities capital cost of money pursuant to CAS 414 was added to profit. Cost of money is an imputed cost paid on negotiated contracts, based on the amount of facilities capital employed on the contract and the market rate of interest prevailing at the time of contract formation. Current DoD policy applicable to R&D and service contracts is to offset profit, dollar for dollar, for any cost of money paid. Therefore, to measure real -- as opposed to apparent -- profit and to find out whether the offset policy is followed, cost of money is added to profit for those R&D and service contracts where it is paid. Thus, an additional $100 payment for cost of money should result in a contract that includes $100 less profit than would otherwise be negotiated. In a contract that does include cost of money, the sum of profit and cost of money should equal the profit in a similar contract that does not include it.

TABLE 2-1. EFFECTIVENESS OF WEIGHTED GUIDELINES FOR MANUFACTURING CONTRACTS (3,686 CONTRACTS)

PROFIT OBJECTIVE RATES			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT	t-VALUE
Intercept		.058	18.14[a]
Contract size		.039	5.42[a]
Material acquisition		-.028	- 8.76[a]
Engineering - direct labor		.006	0.93
Manufacturing - direct labor		-.019	- 4.32[a]
Manufacturing - overhead		-.003	- 0.82
Other costs		-.013	- 3.63[a]
General and administrative (G&A)		.006	1.24
Facilities capital employed		.119	40.09[a]
Special		.024	19.00[a]
Year dummies -	D1 = 1981	.005	9.18[a]
	D2 = 1982	.006	10.14[a]
Contract-type dummies -	D3 = CPIF[b]	.011	10.04[a]
	D4 = FFP[c]	.054	68.88[a]
	D5 = FPI[d]	.038	37.22[a]
Service dummies -	D6 = Navy	.003	3.36[a]
	D7 = Air Force	.004	6.00[a]
R^2 = .77			

NEGOTIATED PROFIT RATES[e]			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT	t-VALUE
Intercept		.061	13.59[a]
Contract size		.029	2.95[a]
Material acquisition		-.010	- 2.35[a]
Engineering - direct labor		.012	1.40
Manufacturing - direct labor		.001	0.14
Manufacturing - overhead		.011	2.10[a]
Other costs		-.001	- 0.12
G&A		.030	4.41[a]
Facilities capital employed		.067	16.21[a]
Special		.016	9.19[a]
Year dummies -	D1 = 1981	.005	5.61[a]
	D2 = 1982	.006	7.25[a]
Contract-type dummies -	D3 = CPIF[b]	.008	5.28[a]
	D4 = FFP[c]	.049	44.46[a]
	D5 = FPI[d]	.039	26.92[a]
Service dummies -	D6 = Navy	-.003	- 3.13[a]
	D7 = Air Force	< .001	0.41
R^2 = .57			

NEGOTIATED PROFIT RATES[e]			
EXPLANATORY VARIABLE		ESTIMATED COEFFICIENT	t-VALUE
Intercept		.027	20.87[a]
Contract size		.002	0.31
Profit objective		.706	53.50[a]
Year dummies -	D1 = 1981	.001	1.63
	D2 = 1982	.002	2.92[a]
Contract-type dummies -	D3 = CPIF[b]	.001	1.03
	D4 = FFP[c]	.014	13.25[a]
	D5 = FPI[d]	.013	10.68[a]
Service dummies -	D6 = Navy	-.005	- 5.99[a]
	D7 = Air Force	-.003	- 3.68[a]
R^2 = .70			

[a] Significant at 5-percent level.

[b] Cost plus incentive fee.

[c] Firm fixed price.

[d] Fixed price incentive.

[e] Cost categories used as explanatory variables are based on values used to determine the profit objective, because amounts actually negotiated are not reported.

FINDINGS

We analyzed both the Government's profit objective going into a negotiation and the profit eventually negotiated. Profit objective and negotiated profit are expressed as rates (i.e., profit as a percentage of cost) in all of the analyses discussed in this chapter. The statistical analysis tested these propositions:

- That DoD's profit objective rate (profit objective as a percentage of cost objective) is determined by the level of facilities capital employed, the mix of costs among cost categories, special fees for productivity and independent development, contract size, contract type, military customer (Army, Navy, or Air Force), and year; and
- That DoD's negotiated profit rates (negotiated profit as a percentage of negotiated cost) are determined by the same factors as those listed above.

Manufacturing, R&D, and service contracts were examined separately. We first examined manufacturing contracts, which have a separate weighted-guidelines formula.

Manufacturing Contracts

Statistical regression results for manufacturing contracts are reported in Table 2-1, where the following results are indicated:

- Facilities capital was significant in the determination of profit rates, as called for in revisions to the weighted guidelines. After all other characteristics were adjusted for, contracts with greater-than-average amounts of facilities capital were awarded higher-than-average profit rates. The statistical significance of facilities capital is indicated by the extremely large "t"-value found for it in each regression equation.
- Although the amount of facilities capital does influence profit, that influence is less than intended by the policy. The profit range called for in the weighted guidelines is 16 to 20 percent for each dollar of facilities capital employed, but each additional dollar of facilities capital actually contributed an additional 11.9 cents to the profit objective. Each additional dollar of facilities capital contributed an additional 6.7 cents to the profit negotiated.
- Engineering labor, the cost category commanding the highest profit rate in the weighted guidelines, is not a significant

The weighted guidelines also assign profit on the basis of total cost, the rate varying with contract type. The variation in the rate reflects differences in risk associated with contract type.

In 1977, facilities capital was included, for the first time, in the weighted guidelines as a profit-bearing category. Facilities capital is measured as the net book value of contractor-owned facilities capital allocated to a contract. Originally, facilities capital was assigned a profit rate in the range of 6 to 10 percent. In 1980, the range was increased to 16 to 20 percent.

If the weighted guidelines play a major role in determining profit rates, profit rates should be higher than average when high-profit-bearing cost categories constitute a significant portion of costs, when fixed-price contracts are negotiated, and when large amounts of facilities capital are employed. Accordingly, profit rates should be lower than average under the opposite circumstances: when low-profit-bearing costs are important, cost-reimbursement contracts are negotiated, and small amounts of facilities capital are employed.

To test these hypotheses, we applied multiple regression analysis to data from 5,434 contracts negotiated using weighted guidelines. Appendix B describes the makeup of the contract data base, drawn from DD 1499 reports. This type of analysis can indicate whether a given cost category is a significant determinant of profit and whether the category increases or reduces profit relative to the average. Analysis of this kind can also show the extent to which the entire weighted-guidelines policy explains negotiated profit rates. We also tested whether profit rates differ by Military Service or contract size, whether they increased or decreased over time, and the extent to which rates change to reflect the risk associated with contract type.

2. THE ROLE OF FACILITIES CAPITAL IN DETERMINING PROFIT

INTRODUCTION

In establishing its initial bargaining position when negotiating a contract, DoD uses the weighted guidelines method. This method relates profit to the resources the contractor will employ in performing a contract. This position is called the "profit objective." The profit ultimately negotiated is presumed to be based on the profit objective and the profit requested by the contractor at the outset of negotiations. Thus, the weighted guidelines should influence both the profit objective and the profit eventually negotiated between DoD and the contractor. Factors not considered in the weighted guidelines may also play a role in the negotiation of contract profit. Appendix A describes the weighted guidelines formula.

This chapter presents our analysis of the role played by facilities capital in determining contract profit. The weighted guidelines apply different profit rates to various categories of anticipated contract costs. Because facilities capital represents only one category and the various categories are additive under the weighted guidelines method, it is necessary to examine all categories to isolate the effect of facilities capital.

In the weighted guidelines method, profit rates are lower for some cost categories, such as material acquisition, than for others. Categories such as engineering labor are assigned higher-than-average profit rates. Consequently, contracts that are relatively heavy in high-profit cost categories should have higher-than-average overall profit rates; contracts that are heavy in low-profit categories should have lower-than-average overall profit rates.

Our analysis of individual companies revealed no differences in the ratio of net income to assets, to equity, or to sales between defense and commercial companies, with the exception of one measure for one group. When the return on assets and the return on equity were calculated on the basis of cash flow instead of net income, the defense companies with a high level of defense business were no different from commercial companies, while the medium- and low-defense companies showed higher returns than commercial companies.

A preferred measure of return based on annual stock price appreciation plus dividends (called "market return") was also calculated. All groups showed similar market rates of return, except that companies with a low proportion of DoD business had lower returns than commercial companies.

Risk was measured by the variability of returns over time, based on the standard deviation about the mean rate of return. The sample of defense contractors never displayed more riskiness than the commercial companies. The companies with a high level of defense business were never significantly different in risk from the commercial companies.

We also found that the risk-return tradeoff is the same for defense contractors and commercial companies. Investors require the same financial return for risk, whether they invest in defense companies or others.

Modifying the present profit structure by reducing the influence of cost and increasing the influence of facilities capital as determinants of profit would not encourage cost-reducing investments. At best, it would make all investments equally attractive without regard to their ability to reduce costs.

We found two ways of encouraging investment in facilities that will reduce costs. One is for DoD to share the savings with the contractor who makes such investments. In the second approach, DoD could change the profit structure to apply different profit rates to investments that yield different benefits to DoD. Instead of the uniform profit rate, which is now applied to all facilities capital employed, irrespective of type, a variety of profit rates could be applied to a variety of assets. The highest rates would apply to investments that offer the highest benefits to DoD.

COMPARATIVE ANALYSIS OF RISK

DoD must offer its contractors the opportunity to earn returns comparable to opportunities available elsewhere in the economy. Otherwise, contractors will not be willing to maintain a long-term commitment to DoD. The return offered should not only reflect returns on competitive alternatives but should also compensate for any additional uncertainty associated with DoD work.

We have compared returns earned over a long time period by firms making similar products for commercial markets and DoD. We have also measured and compared variability of return to determine whether a premium is needed to compensate for any additional uncertainty associated with DoD work. We divided the sample of defense contractors into high, medium, or low defense, depending on the proportion of sales to DoD.

The trend of the ratio of facilities capital to business base indicates the investment behavior of contractors. When the ratio increases over time, more intensive use of facilities capital is indicated. A constant ratio over time indicates a rate of investment that is just adequate to keep up with business activity. A declining ratio indicates inadequate investment and a decline in the capital intensity of production. An increase in the ratio over time, however, though essential to support the proposition that DoD's revised pricing policies encouraged contractor investment, would not, by itself, prove it.

The investment behavior of DoD contractors can also be compared to the overall U.S. economy by measurement of comparable economy-wide data over the same period of time. Such a comparison would show whether DoD contractors had intensified their use of facilities capital by comparison with durable goods manufacturers serving other markets. It is thus possible to examine DoD contractors relative to both their own past practices and the behavior of durable goods manufacturers generally. It should be remembered that defense contractors began the period with a considerably lower ratio of facilities capital to business base than is true of durable goods manufacturers generally. This finding, taken from "Profit '76," is confirmed in our data.

Data Sources

Four alternative sources of data describing contractor investment in facilities capital and the corresponding DoD business base were analyzed. These sources serve as independent checks on each other and present a consistent picture of what has occurred. In each instance, the information presented comes from a different collection of business segments, but the time period, accounting concepts, and definitions used are all the same.

The primary data base was assembled from a sample of "Cost of Money Factor" (CMF) forms used by DoD to pay a business' or segment's cost of money pursuant to CAS 414. Additional measures of facilities capital and business base were assembled from DD Form 1499, "Profit Review Report for Individual Contracts," published annual reports, and Form 10-K reports filed with the Securities and Exchange Commission. The Defense Financial and Investment Review (DFAIR) data collection effort, conducted by Touche Ross & Co., provided aggregated information about the behavior of the ratio of assets to sales. Finally, we drew on the Quarterly Financial Report, which is now published by the Bureau of the Census (formerly published by the Federal Trade Commission and here referred to as FTC), to establish the economy-wide standard of comparison. Data sources and sample selection criteria are described in more detail in Appendix C.

INVESTMENT BEHAVIOR: BY SEGMENT

Table 3-1 presents the investment behavior of the defense industry and the durable goods manufacturing sector from 1978 to 1982. The first six columns show facilities capital (remaining book value), business base (total cost or sales), and the ratio of facilities capital to total cost or sales (intensity of capital use) for 1978 and 1982. The last three columns list average annual rates of growth (percentage) for each of these variables over this period.

Our primary source of data, CMF forms, has been divided into three subgroups: those from Profit Study "82" by the Air Force Systems Command (AFSC), those compiled by the Logistics Management Institute (LMI), and, our preferred source, the combined results from the two subgroups. Our selection criteria for usable data reduced AFSC's original sample of 45 segments from 15 firms to 14 segments from 10 firms.

TABLE 3-1. FACILITIES CAPITAL AND BUSINESS BASE BEHAVIOR OF DEFENSE INDUSTRY

	FACILITIES CAPITAL NET BOOK VALUE ($000,000)		BUSINESS BASE (TOTAL COST OR SALES) ($000,000)		RATIO: FACILITIES CAPITAL TO BUSINESS BASE (PERCENT)		AVERAGE ANNUAL GROWTH RATE: 1978-82 (PERCENT)		
	1978	1982	1978	1982	1978	1982	Facilities Capital	Business Base	Ratio: Facilities Capital to Business Base
CMF Forms:									
AFSC "Profit 82" Sample Selected	$ 446	$ 1,287	$ 7,746	$ 13,216	5.76%	9.74%	30.3%	14.3%	14.0%
LMI Sample	1,940	3,796	14,360	16,839	13.51	14.14	18.3	16.9	1.1
Combined AFSC & LMI (45 firms, 152 segments)	2,386	5,084	22,106	40,055	10.79	12.69	20.8	16.0	4.1
Annual Reports									
Commercial segments (46)	63,870[a]	95,193[a]	73,139	94,220	Not calculated		10.1	6.5	Not calculated
Government segments (52)	11,879[a]	23,807[a]	25,744	51,256	Not calculated		19.0	18.8	Not calculated
DD 1499's									
Contracts using weighted guidelines and cost of money	766	2,386	8,823	24,182	8.68	9.87	Not appropriate	Not appropriate	3.3
DFAIR/Touche Ross & Co.	2,179	5,738	26,287	54,770	8.28	10.48	Not appropriate unless modified	Not appropriate unless modified	6.0
FTC all-durable manufacturing	156,902	257,948	692,436	875,698	22.66	29.46	13.2	6.1	6.8

[a]Not strictly comparable with rest of chart because these are total assets; elsewhere, fixed assets are cited.

The results from the sample of CMF forms show the highest facilities capital growth for aerospace segments in the AFSC sample. Facilities capital growth of over 30 percent per year is consistent with what was reported in Profit Study "82." However, Profit Study "82" never reported corresponding growth in the business base, which we found to be 14.3 percent a year. Segments added from the LMI sample displayed lower facilities capital growth (18.3 percent a year) and higher business base growth (16.9 percent a year) than did the AFSC sample. The LMI sample added 138 segments, considerably more than there were in the AFSC sample, and also covered more end products.

At the start of the period, the aerospace segments in the AFSC sample were considerably lower in capital intensity ($5.76 of capital per $100 of cost) than the firms in the LMI sample ($13.51 of capital per $100). Though the gap narrowed, capital intensity for the aerospace firms never caught up. The combined AFSC and LMI sample, consisting of 152 segments from 45 firms, is displayed in the third line of Table 3-1.

The next section in Table 3-1 presents results from our sample of published annual reports (and Form 10-K submissions). These results are not fully compatible with the results reported elsewhere in the table, because facilities capital (fixed assets) is not generally identified by segment in published reports. In this section we report total assets, both fixed and current. Current assets include accounts receivable, marketable securities, cash, and inventories net of progress payments. For this reason, we have not relied on this source as an indicator of changes in the rate of assets to business base for commercial or Government segments. Instead, we have drawn on the growth rates of assets and business base to confirm the values shown elsewhere in the table.

The Annual Reports section indicates a business base growth of 18.8 percent per year for Government segments. This figure is slightly higher than the values found in the CMF data base. The business base growth of 6.5 percent a year in commercial business matches the 6 percent growth rate among durable goods manufacturers. Again, asset growth is not comparable with the rest of the table and, though reported, is used only to confirm trends.

The next two sections of Table 3-1 present results from the DD Form 1499 contract data base and the DFAIR survey. It is inappropriate to examine separately the growth rates for facilities capital or business base from these sources, because they do not necessarily track the same firms or segments over time. The ratio of facilities capital to business base is an appropriate measure, and the results for this ratio are consistent with other data sources. At the start of the period, contractors employed $8.68 of facilities capital per $100 of costs ($8.28 of facilities capital per $100 of sales, in the case of the DFAIR survey data). These ratios grew over the period at annual rates of 3.3 and 6.1 percent, respectively. These growth rates found in the DD Form 1499 and DFAIR samples compare with a growth rate of 4.1 percent a year from the combined CMF form sample. Thus, these other sources provide results that bracket the value found from the CMF form sample.

Our economy-wide standard of comparison is the durable goods manufacturing sector, taken from the Quarterly Financial Report. The accounting concepts used to construct comparative statistics for durable goods manufacturers are consistent with the definitions of facilities capital and business base in the various samples of defense segments. Facilities capital is net property, plant, and equipment -- equivalent to the remaining book value of fixed assets. Business base means total operating costs, including G&A expenses and

depreciation. The business base defined for durable goods manufacturers thus corresponds to total costs in Government contract accounting.

Table 3-1 shows that durable goods manufacturers increased their facilities capital at a rate of 13.2 percent a year from 1978 through 1982. This is considerably less than the growth in facilities capital investment observed from any of the sources for defense industries over the same period. Business base growth observed for durable goods manufacturers was at the rate of 6.1 percent a year over this period, also considerably lower than for the Government segments. As a consequence, the ratio of facilities capital book value to total cost grew at 6.8 percent a year. This rate of growth is somewhat higher than is found in the defense samples. Accordingly, the gap in the ratio of facilities capital to business base between Government and commercial segments did not narrow during the period.

However, the behavior of the ratio of facilities capital to business base in the commercial sector is highly sensitive to the period selected for this computation. The reason is that investment in facilities capital tends to require long leadtimes for planning and execution, in contrast to the commercial business base, which can be quite volatile in reaction to the business cycle. Table 3-2 displays the annual growth rate for facilities capital to total cost in the durable goods sector, considering alternative beginning and ending years. Table 3-2 illustrates the volatility of that ratio, depending on the period selected. There was a rapid rise in the business base from 1978 to 1979, a major recession from 1980 to 1982, and a rise between 1982 and 1983. Facilities capital grew rapidly until 1982, when the recession brought new investment to a near halt. Consequently, the ratio of facilities capital to business base fell in 1983. Similarly, using 1979 as the starting point leads to a higher annual rate of growth than does starting in 1978. Choice of

starting and ending periods can lead to a near doubling of the growth in the ratio of assets to business base. The range of growth rates observed is quite broad, making comparisons difficult, although the growth rate for durable goods is always higher than the growth rate for the defense sector. Note that the ratio of facilities capital to business base for DoD-oriented segments can be expected to be less volatile and thus less sensitive to the specific period chosen.

TABLE 3-2. FACILITIES CAPITAL AND BUSINESS BASE OF DURABLE GOODS MANUFACTURERS: SELECTED YEARS 1978 TO 1983

(Millions of Dollars)

	1978	1979	1982	1983
Business base (total costs)	$692,436	$802,366	$875,698	$924,745
Facilities capital (fixed assets)	156,902	180,387	257,945	267,928
Ratio of facilities capital to business base	22.7%	22.5%	29.5%	29.0%

Annual growth rate in ratio of facilities capital to business base	ENDING YEAR	
STARTING YEAR	1982	1983
1978	6.77%	5.02%
1979	9.45	6.55

SOURCE: Quarterly Financial Report, Bureau of the Census, Department of Commerce, Washington, D.C.

INVESTMENT BEHAVIOR: BY SIZE AND PRODUCT LINE

The information about facilities capital and business base in the CMF form data base was also examined by defense product line. Segments were divided among seven lines: aircraft, shipbuilding, vehicles, ordnance, missiles, electronics, and a variety of services. Segments were also broken

out by size on the basis of values observed in 1978: large segments with over $50 million in facilities capital and small segments with under $50 million in facilities capital. Facilities capital, business base, and the ratio of facilities capital to business base for 1978 and 1982 are recorded in the first six columns of Table 3-3. Average annual growth rates for facilities capital, business base, and the ratio of facilities capital to business base are reported in the last three columns. Large segments began and ended the period with considerably more assets used per dollar of costs incurred than small segments. However, small segments increased their use of facilities capital relative to costs at a higher rate. Consequently, the small segments closed the gap somewhat.

The analysis of product subsectors indicates considerable difference among sectors in the capital intensity and in the rate of growth of facilities capital relative to cost. Shipbuilding, electronics, missiles, and ordnance began the period with the highest ratios of facilities capital to cost. The same subsectors finished the period with the highest ratios of facilities capital to cost but with the ranking of shipbuilding and ordnance in these four subsectors switching places. Shipbuilding declined, becoming the fourth most capital intensive; ordnance became the most capital intensive.

The last three columns of Table 3-3 show that aircraft, vehicles, and ordnance experienced above-average increases in the use of capital per dollar of costs. Shipbuilding experienced a decline.

TYPE OF ASSETS ACQUIRED

As a rule, little is available from published sources about the types of assets acquired by business firms. Annual reports generally indicate the level of total fixed assets under the categories of property, plant, and

TABLE 3-3. FACILITIES CAPITAL AND BUSINESS BASE BEHAVIOR FOR DEFENSE PRODUCT LINES

	FACILITIES CAPITAL ($000,000)		BUSINESS BASE (TOTAL COST) ($000,000)		RATIO: FACILITIES CAPITAL TO BUSINESS BASE (PERCENT)		AVERAGE ANNUAL GROWTH RATE: 1978-82 (PERCENT)		
	1978	1982	1978	1982	1978	1982	Facilities Capital	Business Base	Ratio: Facilities Capital to Business Base
Large ($50 million in 1978) (10)	$1,127	$2,239	$ 8,347	$14,019	13.5%	16.0%	18.7%	13.8%	4.3%
Small (remainder)	1,258	2,845	13,760	26,036	9.1	10.9	22.6	17.3	4.6
Aircraft (23)	656	1,808	9,651	16,290	6.8	11.1	28.8	14.0	13.0
Shipbuilding (5)	636	759	3,609	5,863	17.6	13.0	4.5	12.9	7.4
Vehicles (3)	17	92	284	818	6.0	11.2	52.1	30.2	16.8
Ordnance (5)	41	107	417	667	9.9	16.1	27.1	12.4	12.9
Missiles (15)	173	422	1,631	3,193	10.6	13.2	24.9	18.3	5.6
Electronics (66)	623	1,330	4,548	9,397	13.7	14.2	20.9	19.9	0.8
Technical services research and data processing (10)	43	147	333	1,073	12.9	13.7	36.0	33.9	1.6

NOTE: Not all segments in the CMF data base have been assigned to a product line.

equipment, but these categories apply to the company as a whole; information about segments of companies is not available. Published data at the segment level usually indicate total segment assets (fixed plus current assets).

To measure what types of assets have been acquired in defense-oriented segments, we obtained results of a special one-time survey by the General Accounting Office (GAO). Proprietary data from individual companies were made available to GAO on the basis that they not be disclosed separately or used for any other purpose. At our request, GAO furnished the data in "index" form for the aggregate of all 267 segments from 58 corporations in the survey. The "index" shows both the percentage distribution of annual capital expenditures for 15 categories of asset type and the percentage increase in total investment expenditures in any one year relative to the base year.

The data in Table 3-4 indicate that, on a constant-dollar basis, there was 2.27 times the amount of gross investment in year 5 compared to year 1. This corresponds to a growth of 22.8 percent per year in annual gross investment expenditures. The data in Table 3-4 also indicate that, over a five-year period, the percentage of annual capital expenditures devoted to buildings increased, while the percentage devoted to the categories of machinery and equipment and of instruments and test equipment declined. Investment expenditures in other categories remained constant in terms of their relative importance.

The most important categories on a constant-dollar basis over the five years were machinery and equipment (35 percent), buildings (18 percent), data processing equipment (11 percent), and instruments and test equipment (10 percent). These four categories accounted for nearly three-quarters of the total expenditure.

TABLE 3-4. DISTRIBUTION OF ANNUAL CAPITAL EXPENDITURES BY TYPE OF ASSET ACQUIRED

ASSET CATEGORIES	PERCENTAGE DISTRIBUTION OF INVESTMENT EXPENDITURES				
	Year 1	Year 2	Year 3	Year 4	Year 5
Land improvement	1.1%	1.4%	1.8%	2.5%	1.4%
Buildings	11.6	13.7	17.9	18.3	23.1
Building installation	5.4	6.9	8.6	7.9	6.6
Building improvements	0.8	4.4	1.1	1.8	1.7
Machinery and equipment	36.7	35.3	36.8	35.9	31.8
Instruments and test equipment	12.4	12.4	10.3	9.4	9.5
Durable tools	3.4	2.8	1.6	2.5	2.3
Other miscellaneous equipment	1.4	1.3	1.6	1.2	1.3
Data processing equipment	15.3	9.0	9.1	9.5	13.1
Transportation equipment	1.5	1.4	1.4	1.0	1.0
Aircraft and vessels	2.3	0.6	0.9	1.6	0.5
Furniture and fixtures	5.1	5.4	5.2	4.6	5.6
Capitalized leases	1.1	0.9	0.5	0.9	0.4
Miscellaneous other	1.9	4.5	3.2	2.9	1.7
TOTALS	100.0%	100.0%	100.0%	100.0%	100.0%
Constant-dollar total relative to year 1	1.000	1.290	1.817	2.077	2.268

SOURCE: GAO special survey made available to LMI.

PRODUCTIVITY

The objective of pricing policies that encourage capital investment is to reduce DoD's acquisition prices. Capital investments that result in price reductions are identifiable in terms of their effects on productivity. More should be produced from less resources consumed (more output for less input).

For commercial sectors of the economy, it is usually possible to measure accurately any trends in productivity. Output measures are often available in physical terms (bushels of wheat, tons of steel, or units produced), and such measures of productivity as physical output per worker can be readily computed. In other instances, it is possible to use product price deflators

for the computation of constant-dollar output or value added. Constant- or real-dollar output can then be used to measure productivity by computing trends in real output per worker.

Defense sectors present some unique problems in defining productivity trends. The majority of defense procurement contracts are negotiated bilaterally between the contractor and the Government, on the basis of expected costs. The dollar value of output is thus related directly to costs. Increases in the prices of resources used to manufacture defense products should translate into corresponding changes in final product prices paid by DoD. A productivity measure comparing output and input in dollar terms is therefore not valid, because the value of the output is related directly to the value of the input.

We have compiled productivity statistics for product sectors where defense purchases play an important role: aircraft and parts, ordnance, ship-building, and missiles. Within aircraft and parts are subsectors consisting of aircraft, engines, and equipment. Table 3-5 displays the rate of growth in value added per employee and value added per production worker in these sectors. Also shown are rates for all U.S. manufacturers. Value added is the correct output measure for calculating productivity, because it eliminates the effects of changes in the importance of material purchases and subcontracts.

The first two columns of Table 3-5 display average annual growth in value added per employee and per production worker, where value added is stated in current dollars. The last column gives the growth rate of value added per production worker in constant dollars. The growth rate for all manufacturers was deflated by 8.02 percent, representing the annual rate of inflation for total gross national product over this period. Defense sectors were similarly deflated, using the DoD price deflator for major commodity procurements excluding fuel, which corresponds to 8.59 percent a year.

Table 3-5 shows that, on the basis of the deflators used, most defense sectors experienced equal or greater labor productivity growth than the rate experienced economy-wide in all manufacturing. Missiles, shipbuilding, and ordnance all experienced productivity growth considerably in excess of the economy-wide rate. Aircraft and parts was somewhat below economy-wide results. However, subsectors of this larger sector displayed varied results, with engines above average and equipment below average.

TABLE 3-5. PRODUCTIVITY GROWTH RATES: 1978-1984

(Average Annual Percentage Growth Rate)

SECTOR	VALUE ADDED PER EMPLOYEE (CURRENT DOLLARS)	VALUE ADDED PER PRODUCTION WORKER (CURRENT DOLLARS)	VALUE ADDED PER PRODUCTION-WORKER-HOUR (CONSTANT DOLLARS)
All manufacturers	8.4%	8.7%	0.68%
Aircraft and Parts	9.5	8.7	0.11
Aircraft	9.0	9.2	0.61
Engines	9.7	10.7	2.11
Equipment	8.5	5.7	-2.89
Ordnance	11.7	12.6	4.01
Shipbuilding	12.0	11.6	3.01
Missiles	10.0	11.0	2.41

SOURCE: Census of Manufactures and Annual Survey of Manufactures, Bureau of the Census.

A final source of information about the effectiveness of investment in defense sectors comes from the DD Form 1499 data base. This source was aggregated to show the distribution of costs by labor categories. For contracts in which the weighted guidelines were used, the percentage of costs falling in the engineering labor, manufacturing labor, and services labor categories was computed for the period 1977 to 1983. Service labor, as a separate cost category, was introduced in 1980; before then, it was probably included with manufacturing labor.

Table 3-6 displays the percentage of costs by labor category and in total. It is evident that total labor costs as a percentage of total contract costs displays a declining, albeit irregular, trend over the period. This is also true of engineering labor and manufacturing labor, although it is likely that what was labeled "service" labor after 1979 had appeared earlier in one or both of the other categories. The decline in the importance of labor in contract costs is one more indicator of productivity enhancement. It is not definite proof, but it does suggest a trend toward increasing productivity.

TABLE 3-6. PERCENTAGE DISTRIBUTION OF LABOR COSTS IN DOD CONTRACTS

LABOR COST CATEGORY	1977	1978	1979	1980	1981	1982	1983
Engineering labor	9.7%	8.9%	11.3%	10.6%	8.6%	7.4%	6.9%
Manufacturing labor	11.5	10.6	8.4	7.7	10.2	8.0	9.7
Service labor	-	-	-	.5	1.9	1.5	1.0
TOTAL LABOR	21.2%	19.5%	19.7%	18.8%	20.7%	16.9%	17.6%

SOURCE: DFAIR-prepared DD Form 1499 data base.

CONCLUSIONS

We have found clear evidence of a high rate of investment between 1978 and 1982 by defense contractors, defined as business segments doing the majority of their work for DoD. Investment has been measured by the remaining book value of facilities capital (fixed assets). Between 1978 and 1982 this measure grew at a rate of about 20 percent a year for defense contractors, compared with about 13 percent a year for durable goods manufacturers generally.

Business activity (measured by total cost) for defense contractors grew at a high rate of about 16 percent a year between 1978 and 1982. A comparable measure for durable goods manufacturers grew about 6 percent a year over the

of Table 4-5 illustrates a policy by which the contractor's IRR increases from 15 percent for the no-cost reduction investment up to 25 percent for he investment with the high productivity gain. The table indicates that the profit rate applied to facilities capital employed would have to be scaled up from 13 percent to slightly over 40 percent to provide increasing IRRs of the magnitude indicated.

It therefore appears feasible to direct the profit rate associated with different types of assets in a way that encourages contractors to invest in the most productive assets. Precise definition of such a policy would, however, require information on representative savings achieved by DoD contractors for various types of assets.

SUMMARY

The illustrations described above are representative of the application of policy alternatives that can be investigated using the cash flow model.

We have used the model to verify that the current profit component of contract pricing can discourage investments that lead to substantial cost reductions for DoD. Investments that lower contractor costs erode the total cost base on which a substantial part of the contractor's profit is now determined.

DoD, however, moderates those results by sharing cost savings -- either as contract cost incentives or through sharing agreements under IMIP.

Changing the profit structure by reducing the importance of cost as a determinant of profit and increasing the importance of facilities capital would not directly encourage cost-reducing investments. At best, it would make all possible investments equally attractive without regard to their ability to reduce costs. Sharing of cost savings between DoD and the contractor, however, would be necessary to encourage productivity-enhancing investments.

have a lower profit rate applied to their remaining book value. Under this approach, higher profit paid on facilities capital offsets "lost" profit due to reduced cost.

The model allows quantification of this concept. Table 4-5 presents the required profit rate on facilities capital to achieve certain illustrative contractor target IRRs. Investments were varied from those which produce no cost reduction to those producing a 23.5-percent cost reduction and a 47-percent cost reduction.

TABLE 4-5. REQUIRED PROFIT RATES ON FACILITIES CAPITAL[1]

PERCENT ANNUAL COST REDUCTION	TARGET CONTRACTOR IRR (AFTER-TAX, NO SAVINGS ON EXISTING CONTRACT) (PERCENT)	REQUIRED PROFIT RATE ON FACILITIES CAPITAL (PERCENT)
0	20	22.4
23.5	20	26.8
47	20	31.2
0	15	13
23.5	20	26.8
47	25	40.5

[1]Results based on straight-line depreciation, eight-year service life, asset placed in service in second year, CAS 414 rate of 10 percent, profit on cost of 10 percent, profit on depreciation of 5 percent, and Federal tax rate of 46 percent.

The first three lines indicate that progressively higher profit rates must be assigned to facilities capital employed to yield identical 20-percent contractor IRRs as investments provide greater cost reductions. The profit rate needed to yield a 20-percent IRR increases from 22.4 percent for the no-cost reduction investment up to 31.2 percent for the investment that reduces annual costs by 47 percent.

We next examined the implication of a policy that positively encourages investments that lead to the greatest cost reductions. The bottom half

Line 2.3 illustrates an exclusively capital-based profit policy in which the 16-percent profit on facilities capital employed is retained and all profit related to cost incurred is eliminated. Contractor IRR (at 15.9 to 22.9 percent) is higher in this case than in either of the two preceding cases, because the cost savings do not give rise to "lost profit." This exclusively capital-based policy can also be applied to investments with different rates of cost savings (Table 4-4). An exclusively capital-based profit policy without sharing leads to contractor indifference among investments with different cost savings -- the same return, depending only on the dollar value of the investment, is earned. The contractor does better with the more productive investment when the contractor captures a share of the savings on existing contracts (see the last column of Table 4-4).

TABLE 4-4. CONTRACTOR IRR FROM COST-REDUCING INVESTMENT: PURE CAPITAL-BASED PROFIT POLICY

LINE	PERCENT COST REDUCTION	CONTRACTOR IRR (PERCENT)	
		NO SAVINGS ON EXISTING CONTRACTS	WITH SAVINGS ON EXISTING CONTRACTS
1.3	0	15.9	15.9
2.3	23.5	15.9	22.9
3.3	47.0	15.9	32.3

Directed Profit Rates

Finally, the model was used to investigate the feasibility of separate "directed" profit rates applied to various types of facilities capital. This approach differentiates among asset types on the basis of presumed cost-saving benefits to DoD. Higher profit rates are applied to the remaining book value of assets that will most likely produce significant cost reductions. Conversely, assets thought to generate little or no cost savings

When the contractor receives all of the first year's savings on the existing contracts, there may be sufficient additional cash flow received so that contractor's return increases with greater savings, as is the case shown in Table 4-3. Cost-type and incentive contracts may not offer enough sharing of savings for this to be true. Even fixed-price-type contracts may not contain enough additional incentive and may require explicit sharing arrangements beyond what is available on existing contracts to offer an adequate return to the contractor. The Industrial Modernization Incentives Program (IMIP) is one such DoD attempt at explicit sharing of savings.

Variations in Profit Formula

Five alternative profit policies were tested for their ability to encourage cost-reductions using the investment with a 23.5-percent cost reduction rate. The results are displayed on Lines 2.1 through 2.5 of Table 4-1.

Current profit policy is reflected in Line 2.1, where profit is paid on facilities capital employed, depreciation, and total cost base (excluding depreciation). Results show that the after-tax IRR for an investment that reduces annual contract costs by 23.5 percent is between 14.1 percent and 20.9 percent (depending on the contractor-retained share of the savings on existing contracts).

Line 2.2 represents a profit policy in which facilities capital is eliminated as a determinant of profit. This exclusively cost-based policy leads to significantly lower IRRs (4.6 to 10.3 percent). The cost-saving investment lowers the cost base on which profit is determined. Only the facilities' capital-related payments from CAS 414 imputed cost of money, depreciation, and profit on depreciation contribute to cash inflow -- profit is actually reduced as cost falls.

or "first" priority for investment by the contractor. This is illustrated in Table 4-2.

TABLE 4-2. CONTRACTOR IRR FROM COST-REDUCING INVESTMENT

LINE	PERCENT COST REDUCTION	CONTRACTOR IRR (NO SAVINGS ON EXISTING CONTRACTS) (PERCENT)
1.1	0	16.6
2.1	23.5	14.1
3.1	47.0	11.5

The reason for "worst-first" is that the cost-related component of profit policy imposes the greatest penalty on those investments that reduce cost the most. Profit is lost because costs are reduced. Consequently, the best investment earns the contractor the lowest return. This perversity in the existing policy, of course, has long been recognized.

Role of Sharing

The "worst-first" phenomenon that can occur under current pricing policy can be obviated through sharing of savings. To see that this is the case, examine contractor return when all savings on existing contracts go to the contractor (Table 4-3). The assumption used in these examples is that all of the savings generated in the year of the investment go to the contractor.

TABLE 4-3. CONTRACTOR IRR FROM COST-REDUCING INVESTMENT: WITH SHARING

LINE	PERCENT COST REDUCTION	CONTRACTOR IRR (WITH SAVINGS ON EXISTING CONTRACTS) (PERCENT)
1.1	0	16.6
2.1	23.5	20.9
3.1	47.0	27.0

The policies described in the middle part of Table 4-1, Lines 2.1 through 2.5, are profit policy variations applied to a facilities capital investment that annually saves 23.5 percent of its acquisition value. This particular savings percentage was selected because it corresponds to an investment yielding zero DoD benefit under current pricing policy and the other assumptions applicable to Table 4-1. Line 2.1 represents the current DoD policy, under which a contractor earns an after-tax IRR on cash flow of 14.1 percent to 20.9 percent, depending on whether savings on existing contracts go to the contractor. Investments with a 23.5-percent cost reduction are advantageous to DoD, provided all savings on existing contracts go to DoD. Lines 2.1, 2.2, and 2.3 repeat the policies found in the top section of the table. Lines 2.4 and 2.5 represent possible policies with higher profit rates on cost and facilities capital employed, respectively.

The bottom section of Table 4-1, Lines 3.1, 3.2, and 3.3, also repeats the policies found in the topmost section of the table. The investment in these instances is assumed to generate twice the amount of cost savings as found in the middle case (47 percent rather than 23.5 percent).

The results of the simulations displayed in Table 4-1 lead to a number of policy conclusions. The results displayed are by no means the totality of policy alternatives that can be analyzed. However, some basic policy findings can be inferred from these results. They are discussed next.

"Worst-First" Investments

The DoD profit policy should encourage contractor investments in facilities that reduce the contract price paid by DoD. Comparison of contractor returns reported on Lines 1.1, 2.1, and 3.1 indicates that under the current policy, the highest return is earned for the investment with the least cost reduction to DoD. Thus, the "worst" cost reduction receives the highest

described in Column (4) by the annual cost reduction; e.g., annual cost reduction of 23.5 percent of the investment. In each case the investment is $100. Contractor results are displayed in Columns (5) and (6) by the IRR on after-tax cash flow assuming no savings to the contractor on existing contracts, Column (5), and with all savings for the first year going to the contractor, Column (6). Columns (7) and (8) display DoD's dollar benefits (undiscounted) also on the assumption of no savings to the contractor on existing contracts, Column (7), and all savings for one year going to the contractor, Column (8). All results displayed in Table 4-1 assume straight line depreciation over an eight-year service life, a cost-of-money rate of 10 percent, a contractor Federal tax rate of 46 percent, an investment tax credit of 10 percent, and depreciation for tax purposes according to accelerated cost recovery system tables applied to a five-year asset class.

TABLE 4-1. SIMULATION RESULTS FOR ALTERNATIVE PROFIT POLICIES

PRODUCTIVITY GAIN	LINE	PROFIT POLICY (1) RATE ON FCE	(2) RATE ON DEPRECIATION	(3) RATE ON COST	(4) ANNUAL COST REDUCTION PER INVESTMENT $	CONTRACTOR IRR (AFTER TAX) (5) NO SAVINGS ON EXISTING CONTRACTS	(6) WITH SAVINGS ON EXISTING CONTRACTS	DoD DOLLAR BENEFIT (7) NO SAVINGS ON EXISTING CONTRACTS	(8) WITH SAVINGS ON EXISTING CONTRACTS
1 Zero	1.1	.16	.05	.10	.00	.166	.166	($181)	($181)
	1.2	.00	.05	.10	.00	.074	.074	($126)	($126)
	1.3	.16	.00	.00	.00	.159	.159	($176)	($176)
2. Medium	2.1	.16	.05	.10	.235	.141	.209	$ 23	$ 0
	2.2	.00	.05	.10	.235	.046	.103	$ 78	$ 54
	2.3	.16	.00	.00	.235	.159	.229	$ 11	($ 12)
	2.4	.16	.05	.16	.235	.126	.192	$ 33	$ 9
	2.5	.20	.05	.10	.235	.163	.233	$ 9	($ 14)
3. High	3.1	.16	.05	.10	.47	.115	.27	$227	$180
	3.2	.00	.05	.10	.47	.015	.145	$282	$235
	3.3	.16	.00	.00	.47	.159	.323	$199	$152

The first part of Table 4-1, Lines 1.1 through 1.3, covers the effects of three profit policies in place when the contractor invests in an asset without any associated cost reduction (see Column (4)). The profit policies are (1) the current one (Line 1.1), (2) an exclusively cost-based policy (Line 1.2), and (3) an exclusively capital-based policy (Line 1.3).

ILLUSTRATIVE APPLICATIONS

The cash flow model was used to determine contractor and DoD returns resulting from a number of alternative pricing policies and facilities investment characteristics. We evaluate pricing policies by examining whether contractor returns are large enough to encourage cost-reducing investments and whether the contractor earns the highest return when achieving the greatest cost reduction. Return is defined as the internal rate of return (IRR) computed for the contractor's after-tax cash flow stream. This IRR is the rate equating the present value of cash inflows to cash outflows. The analysis deals only with additional cash flow and return on new facilities investments. Profit policy alternatives examined were limiting cases of possible policies: all-cost-based, all-capital-based, higher profit rate on cost, and higher profit rate on capital, all compared with the current profit policy. Profit rates of approximately 16 percent on facilities capital employed, 5 percent on depreciation, and 10 percent on total cost base excluding depreciation are representative of current policy. These values are the averages found in the DD Form 1499 contract data base.

Three types of investments were considered. They correspond to zero, medium, and high productivity gains. Productivity gain is measured by the annual percentage cost reduction per dollar of facilities capital invested. Thus, the investment with a 47-percent productivity gain reduces costs by $47 for every $100 of investment.

Table 4-1 presents the simulation results of the alternative profit policies and facilities capital investments described above. Profit policy is described by three profit rates given in the first three columns of the table. These are profit rates on facilities capital employed (FCE), depreciation, and total cost base excluding depreciation, respectively. The investment is

Facilities capital employed is also an important determinant of profit. The model applies profit to the net book value of new facilities capital employed at a profit rate assigned by the user. Profit paid on facilities capital employed is related to depreciation policy. A rapid depreciation method, such as an accelerated method along with a short asset service life, quickly reduces net book value and, thus, annual profit paid on new facilities capital. Slower depreciation rates produce higher net book values and higher annual profit on facilities capital. Consequently, depreciation practices affect contractor cash flow in two ways: (1) directly as an element of contractor cash inflow, since depreciation is an allowable cost, and (2) indirectly, since depreciation practices influence remaining book value and, thus, profit on facilities capital and imputed cost of money on facilities capital.

Depreciation is an allowable contract cost usually found in an indirect cost pool. An investment in new facilities implies additional depreciation costs based on the investment value, depreciation method used, and asset service life selected. Contractor cash flow from depreciation is treated as an element of cash inflow, since depreciation is a non-cash cost to the contractor. Five commonly used depreciation methods and a range of from two to 15 years asset service lives are available in the model.

Contract cost incentives are a potential element of cash inflow. This element refers to any incentives, whether implicit in contract type or explicit in contract price provisions, that are realized by the contractor as a result of cost savings. The contractor receives all of the cost savings on existing firm-fixed-price contracts. However, all cost savings on cost-plus-fixed-fee contracts accrue to DoD. Incentive contracts fall between firm-fixed-price and cost-plus-fixed-fee contracts, with the contractor and DoD sharing the cost savings on existing contracts.

cash flow also requires adjustments to cash inflows, including the investment tax credit applicable to facilities investment, depreciation used to compute taxable income, and payment deferrals based on the completed contract method of accounting.

Defining DoD Benefits

Cash flow analysis also can be used to measure the DoD benefits that result from a contractor's investment in facilities capital. Benefits to DoD occur only when cost reductions from productivity-enhancing investments exceed investment-related payments to the contractor by DoD. Those payments are (1) depreciation on the additional facilities capital, (2) cost of money on the additional facilities capital, and (3) any change in the profit component of price.

Elements of Pricing Policies

The model incorporates three parts of contract pricing: profit structure, depreciation accounting practice, and contract cost incentives.

In the model, we have defined contract profit structure as consisting of three separate profit rates: a profit rate applied to expected contract cost changes (excluding depreciation on new facilities investment), a profit rate applied to depreciation on the new facilities investment, and a profit rate applied to the new facilities capital employed.

Profit is influenced by any change in total cost. An investment that reduces cost also reduces the amount of profit negotiated on future contracts.

We have accorded separate treatment to depreciation as an element of profit policy, because it is a cost tied to facilities investment. It is currently a component of overhead cost and is assigned the profit rate found for manufacturing overhead. For purposes of testing profit alternatives, a separate profit rate on depreciation has been introduced.

Definition of Contractor Cash Flow

Contractor cash flow consists of (1) contractor cash costs that are not immediately offset by equal, opposite receipts from the Government (outflows) and (2) cash receipts from the Government that are not immediately offset by equal opposite payments from the contractor to third parties such as employees or vendors (inflows). Contractor costs and matching payments from DoD that coincide in a reasonably short period of time (less than a few months) are ignored. Consequently, for any contract, the elements of cash flow arising from new contractor investment are as follows:

Cash Outflows:

- Contractor facilities investment expenditures.

Cash Inflows:

- Imputed cost of money based on the remaining book value of the additional facilities capital investment;
- Annual depreciation of the additional facilities capital investment;
- Change in profit due to the investment -- consisting of additional profit based on additional depreciation, additional profit based on additional facilities capital investment, and reduction in profit if contract costs are reduced; and
- Any cost savings (or cost overruns) on existing, already-priced contracts retained by the contractor. Cost savings (or overruns) are dependent on the difference between contract and actual costs, contract type, and contract incentive clauses.

These elements of cash flow are used to compute contractor return on investment on a pre-tax basis. Generally, this is sufficient to analyze DoD pricing policies, since those policies are intended to compensate the contractor on a pre-tax basis.

If after-tax cash flow is to be considered, income taxes must be added as an element of contractor cash outflow. Basing returns on after-tax

4. ALTERNATIVE CONTRACT PRICING POLICIES

INTRODUCTION

This chapter describes a model developed by LMI to analyze DoD contract pricing policies and presents findings from applying the model to illustrative contract pricing alternatives. Three parts of contract pricing are incorporated in the model: the profit component of contract price, depreciation accounting practices, and contract cost incentives.

Contract pricing policies are evaluated on the basis of how well they encourage contractor investments that reduce DoD's contract prices. Such investments must provide contractors with a rate of return competitive with what can be earned on investments elsewhere. The model evaluates contractor return on the basis of discounted cash flow analysis -- the prevailing method used by industry to make investment decisions. Variations in pricing policies influence contractor cash flow from an investment. Cash flow, in turn, determines the return earned by the contractor and thus the attractiveness and likelihood of the investment.

In the following sections we define cash flows that occur from a contractor's investment under Government contract pricing policies. We also define DoD benefits that occur from a productivity-enhancing investment. Finally, we define the components of pricing policies that have been included as features of the model. Appendix E contains a detailed description of the cash flow model, including a sample input-output report and definition of each line item of the model.

industry, we conclude that the revised pricing policies do not encourage use of facilities capital at commercial levels, though they have less of a discouraging effect than the old policies.

same period. The combination of rapid growth in facilities capital at about 20 percent a year and business base growth at about 16 percent a year led to an increase in the relative use of capital in the defense industry. The ratio of facilities capital to business base grew at a rate of about 4 percent a year.

All sources used to measure the growth of the ratio of facilities capital to business base confirmed an increase in this ratio by defense contractors, going from about $11 of facilities capital per $100 of costs to about $13. Durable goods manufacturers over the same period increased their relative use of capital at a somewhat faster rate than defense companies, from about $23 of facilities capital per $100 of cost to about $29.

We also examined the types of assets acquired by defense contractors. Over a five-year period following DoD changes in pricing policies, the most important categories of annual capital expenditures by defense segments were machinery and equipment (35 percent), buildings (18 percent), data processing equipment (11 percent), and instruments (10 percent). Over this period, an increasing percentage of annual capital expenditures was devoted to buildings at the expense of machinery, equipment, and instruments.

Finally, there is evidence indicating growth in productivity that is higher than economy-wide in some sectors that can be clearly identified as defense-oriented. There is also an indication that costs incurred for labor on DoD contracts are declining as contractors increase their use of facilities capital.

We conclude that the available evidence indicates behavior on the part of the defense industry that is consistent with the intent of the policy changes of 1976 and 1980. But, because durable goods manufacturers in general have increased their relative use of capital at a greater rate than the defense

Changing the profit structure to apply different profit rates to investments that have different benefits to DoD would encourage productivity-enhancing investments. The existing uniform profit rate applied to all facilities capital employed, irrespective of type, could be replaced by separate profit rates applicable to different types of assets. The highest rates would apply to investments that offer the highest benefits to DoD. This approach is made more effective by reducing the importance of cost as a determinant of profit.

5. RISK ANALYSIS

INTRODUCTION

DoD must offer its contractors the opportunity to earn financial returns comparable to those available elsewhere in the economy. Otherwise, contractors will be unwilling to maintain a commitment to DoD. The return offered should not only take into account alternatives available elsewhere but should compensate for any additional risk associated with DoD work. This chapter compares returns earned over long periods by firms making similar products for commercial markets or for DoD. Also, the variability of return is measured and compared, to determine whether a premium is necessary to compensate for any additional risk associated with DoD work.

DEFINING COMMERCIAL AND DEFENSE COMPANIES

A sample of defense and commercial companies was compiled on the basis of the Standard Industrial Classifications (SICs) of companies identified for inclusion in the DFAIR Survey. The sample consists of all the companies in Standard and Poor's COMPUSTAT Services' data base falling into the DFAIR Survey companies' SICs. Companies in the COMPUSTAT data base are publicly traded on major exchanges or on the national over-the-counter market. Our sample consists of 214 companies, spread over 26 SICs. Of the total, 65 are defense firms, while the remaining 149 are commercial firms serving non-DoD markets.

The defense contractors have been designated as low, medium, or high defense, depending on whether their DoD sales constitute less than one-third, one-third to two-thirds, or over two-thirds of their overall sales. Company

annual reports, The Value Line Investment Survey, and the Defense Contract Audit Agency report "Independent Research and Development and Bid and Proposal Cost Incurred by Major Defense Contractors" were used for this purpose. Appendix F presents the companies in the sample, along with measures of return and risk associated with each company.

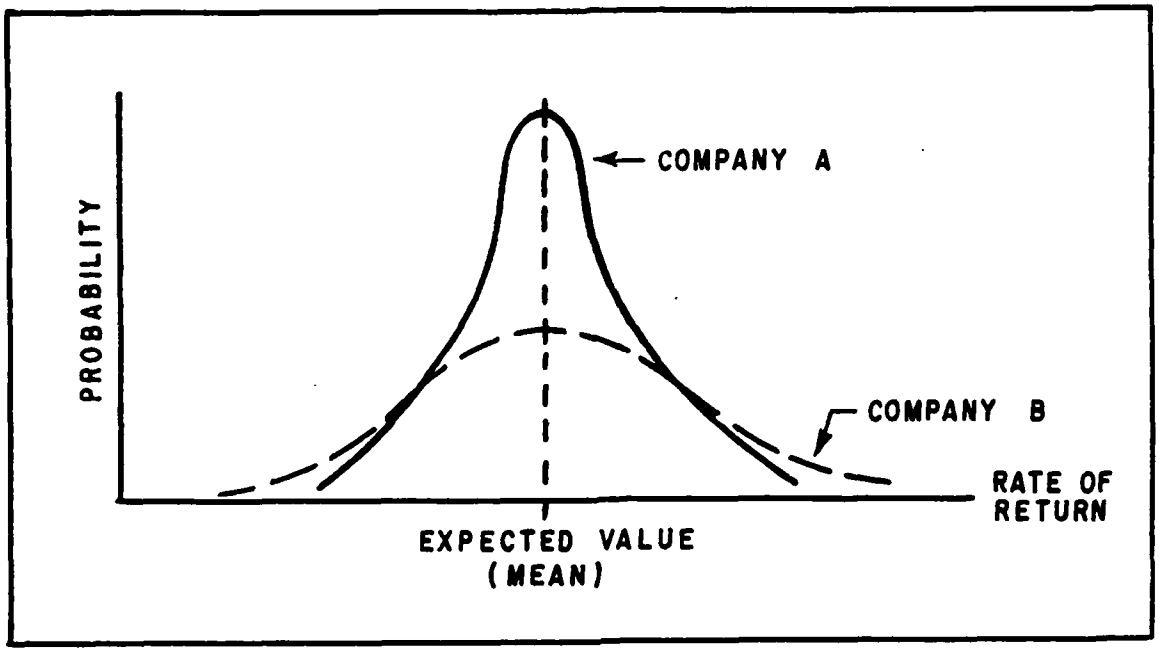
RETURN AND RISK MEASURES

Expected return and its variability are characteristics of variables such as stock price or corporate income that assume unknown values from year to year. Such variables are random, in that they assume various values some of the time and no single value all of the time.

Investment decisions revolve around the notion of a tradeoff between expected return and risk. Unless compensated to assume it, investors prefer to avoid uncertainty. When confronted with two investment opportunities with equivalent expected returns, investors prefer the more certain opportunity. Investors assume additional risk only if they anticipate a higher return. This behavior is referred to as risk aversion, and the additional return required to assume risk is called a risk premium.

Figure 5-1 illustrates the risk-return concept. Companies A and B have the same expected return, as shown by the correspondence of the means of their respective probability distributions. But Company B's outcome is much more variable and hence less certain (variability is indicated by the spread or dispersion of the probability distributions in Figure 5-1). Investors will prefer Company A to B, unless a premium is added to Company B's expected return, to compensate for the uncertainty.

FIGURE 5-1. RISK-RETURN CONCEPT



Expected value for the companies in our sample has been estimated as the mean value, using historic measures of accounting and market returns. Risk has similarly been estimated by calculating the dispersion of return relative to the historic mean given by the standard deviation.[1]

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[1]Formally, the mean for a company is the average return, $\bar{r}$, where

$$\bar{r} = \Sigma r_i / N$$

The standard deviation, σ, is the sum of the annual deviations from the mean, squared, averaged, and then put into the same units as used to measure return, by taking the square root:

$$\sigma = \sqrt{\frac{\Sigma(r_i - \bar{r})^2}{N}} \quad .$$

Return Measures Used

Numerous measures of a company's expected return can be constructed. Each measure has an associated variability that also can be constructed from the same data.

We have calculated expected return by using six different measures. The first five measures are accounting values from annual balance sheet and income statements, such as annual net income expressed as a return on assets or on sales. The sixth measure is market-oriented; it is based on annual stock price appreciation and dividends.

There are reasons to prefer the market-oriented measure over the accounting measures. The market return cannot be managed through changes in accounting conventions to give desired results. More importantly, stock price reflects investor anticipation of future returns, discounted at a rate required by the investor to assume risk. Consequently, a change in investors' perceptions of future returns or riskiness will immediately be reflected in the market price.

The formal definitions of return measures developed for each company in the sample are --

- Net income return on assets: after-tax income divided by total assets;
- Net income return on stockholders' equity: after-tax income divided by stockholders' equity (i.e., net worth);
- Net income return on sales: after-tax income divided by total annual sales;
- Cash flow return on assets: the sum of after-tax income and annual depreciation, divided by total assets;
- Cash flow return on stockholders' equity: the sum of after-tax income and annual depreciation, divided by stockholders' equity (net worth); and
- Market return: the sum of the annual stock price appreciation from the beginning to the end of each calendar year plus the

annual dividend, all divided by the stock price at the beginning of the year.

The first five return measures -- the accounting measures -- were based on annual data over the 10-year period 1974-1984. The last measure -- market return -- covers the period 1965-1985. For each grouping of companies (e.g., commercial, high defense, etc.), an expected return and a measure of risk were computed on the basis of each of the return definitions presented above. The procedure used was to compute the average return for each company over the period and the standard deviation of the annual returns relative to the company's average return. The average return for each company was then averaged for all companies in the group. Similarly, the standard deviation of return for each company was averaged over all companies in the group to produce the group average measure of risk. These results are presented in Table 5-1 for expected rates of return and in Table 5-2 for risk.

RESULTS OF COMPARATIVE ANALYSIS

The analysis of rates of return indicates relatively consistent results across the groups of companies considered. In general, returns, no matter how measured, do not differ significantly among the groups of companies. This is always the case when the comparison is between commercial firms and firms with most of their sales to DoD (high defense). When return is calculated on the basis of cash flow rather than net income, some groups of defense firms do show significantly higher returns. When the market rate of return is used, low defense firms show significantly lower returns than do commercial firms.

Turning to Table 5-2 and the results found for the variability or riskiness of return, we again see no statistically significant differences in risk between commercial firms and those with a high percentage of DoD sales.

TABLE 5-1. COMPARATIVE RATES OF RETURN: COMMERCIAL FIRMS VS. DEFENSE CONTRACTORS

MEASURE OF RETURN	INDUSTRY SECTOR				
	Commercial Firms	All Defense Contractors Combined	Low Defense (<1/3)	Medium Defense (>1/3 <2/3)	High Defense (>2/3)
Net income return on assets	5.2%	6.5%	6.0%	7.4%	6.3%
Net income return on stockholders' equity	9.2	13.3	11.6	16.0[a]	12.7
Net income return on sales	4.6	4.7	4.7	5.3	4.0
Cash flow return on assets	7.6	10.2[a]	10.0[a]	10.6[a]	10.0
Cash flow return on stockholders' equity	15.2	22.1[a]	20.9	23.6[a]	23.5
Market return: price appreciation plus dividends (1965-1985)	22.5	19.6	15.0[a]	24.1	23.5

[a]Significantly different from commercial.

TABLE 5-2. COMPARATIVE MEASURES OF RISK: COMMERCIAL FIRMS VS. DEFENSE CONTRACTORS

RISK MEASURE (Standard Deviation)	INDUSTRY SECTOR				
	Commercial Firms	All Defense Contractors Combined	Low Defense (<1/3)	Medium Defense (>1/3 <2/3)	High Defense (>2/3)
Net income return on assets	5.6%	2.9%[a]	3.0%[a]	2.3%[a]	3.6%
Net income return on stockholders' equity	18.9	7.9a	5.8	5.6	17.8
Net income return on sales	20.4	21.7	19.2	31.8[b]	11.0
Cash flow return on assets	5.5	2.9[a]	2.9[a]	2.5[a]	4.0
Cash flow return on stockholders' equity	18.4	7.5[a]	5.5	5.3	23.2
Market return: price appreciation plus dividends (1965-1985)	62.7	49.2[a]	42.7[a]	55.6	54.2

[a]Significantly less than commercial.

[b]Significantly greater than all other groups.

NOTE: Different sample sizes account for the possibility that equivalent numbers do not lead to equivalent significance results.

The group of medium defense firms (those with one-third to two-thirds DoD sales) shows significantly higher risk in terms of variability of return on sales when compared with all the other groups. However, when net income return on assets and cash flow return on assets are used, medium defense firms show significantly less risk than commercial firms. When these same measures of return are used, low defense firms and all defense firms combined were found to have less risk than commercial firms. On the basis of return on equity, the group of all defense contractors combined shows significantly less risk than do commercial firms. When net income return on assets and cash flow return on assets are considered, all groups except high defense firms have less risk than commercial firms. Finally, on the basis of market rate of return, all defense firms combined and low defense firms have less risk than commercial firms.

DoD firms appear no more risky, measured by variability of returns, than commercial firms.

RELATIONSHIP BETWEEN RETURN AND RISK

Our final analysis seeks to quantify the relationship between return and risk. The objective is to see whether investors require different premiums to assume equivalent risk for defense and commercial companies.

The method employed was to postulate a linear relationship between company returns and risk measures. In principle, we would expect a positive relationship, with high rates of return associated with high risk and low rates with low risk. This relationship was tested by means of linear regression analysis. In addition to observing return and risk for each company, we introduced as a variable in the regression the group to which the company belongs (commercial; low, medium, or high defense; or all defense combined). This procedure employs "dummy" variables and enables statistical

testing to see whether the risk-return relationship is identical for commercial and DoD firms.[1] The analysis was repeated for four measures of return and risk as measured by the standard deviation of return.

Table 5-3 presents regression results for commercial companies and for the three groupings of defense firms: low, medium, and high. In general, when the accounting measures of return are used, returns are lower with increased risk, as shown by the negative values of the coefficient for the standard deviation (risk). The coefficient for the standard deviation is both significant and negative for return on assets and return on equity. It is not different from zero for return on sales.

TABLE 5-3. REGRESSION RESULTS: RETURN VS. RISK FOR COMMERCIAL AND DEFENSE COMPANIES BY TYPE

INDEPENDENT VARIABLES	DEPENDENT VARIABLES			
	Return on Assets	Return on Equity	Return on Sales	Market Return
Intercept	0.080[a]	0.133[a]	0.060[a]	-0.017
Standard deviation of return	-0.510[a]	-0.220[a]	-0.066	0.397[a]
Low defense	-0.005	-0.004	-0.000	-0.003
Medium defense	0.005	0.038	0.014	0.037
High defense	0.001	0.033	-0.013	0.037
R^2 (goodness of fit)	.26	.31	.01	.58

[a]Significant at .05 level.

The only relationship conforming to the anticipated investor behavior is the one for market return -- higher return associated with greater riskiness, as indicated by the positive coefficient for the standard deviation. The

[1]In this analysis, commercial firms were used as the baseline; they are represented in the intercept term of the linear regression results.

relationship estimated by using market return to calculate return and risk is displayed in the last column in Table 5-3. This relationship shows significant increases in return when more risk is encountered and also indicates that the relationship is identical for defense and commercial companies. Market return gives the best overall risk-return relationship, as indicated by the highest R^2 (0.58) in Table 5-3.

Table 5-4 displays estimates of the risk-return relationship for commercial and all defense companies combined. That is, it covers the same data as Table 5-3, but in Table 5-4 the defense firms are aggregated, not broken out by percentage of Government sales. We find the same basic conclusions as in the previous table. The relationship is either in the wrong direction or insignificant for accounting measures of return, and it is most significant and in the proper direction for market return.

TABLE 5-4. REGRESSION RESULTS: RETURN VS. RISK FOR COMMERCIAL AND DEFENSE COMPANIES

INDEPENDENT VARIABLES	DEPENDENT VARIABLES			
	Return on Assets	Return on Equity	Return on Sales	Market Return
Intercept	0.080[a]	0.133[a]	0.058[a]	-0.020
Standard deviation of return	-0.512[a]	-0.219[a]	-0.061	0.401[a]
All defense combined	0.001	0.017	-0.002	0.019
R^2 (goodness of fit)	.26	.30	.01	.56

[a]Significant at .05 level.

The dummy variables for Government business are never significant, and we conclude that the relationship remains the same for commercial and defense companies -- investors require equivalent premiums to assume risk for commercial and defense companies.

CONCLUSIONS

We have found relatively consistent results that do not vary much in their conclusions, no matter which measure of return or risk or grouping of defense contractors is selected.

We looked at rates of return for individual companies. We found no differences in market return between defense contractors and commercial companies, with the exception of one group. We also found no differences between defense contractors and commercial companies in the ratio of net income to assets, to equity, or to sales, with the exception of one measure for one group. However, when the return on assets and the return on equity were calculated using cash flow instead of net income, defense contractors showed higher returns than did commercial companies.

Risk was measured by the variability of returns over time, on the basis of standard deviation about the mean rate of return. The sample of defense contractors never displayed more riskiness than did the commercial companies, with the exception of one measure for one group. In fact, companies with a high level of defense business were never significantly different from the commercial companies for any measure of rate of return or risk.

We also found the risk-return tradeoff to be identical for defense contractors and commercial companies. That is, investors are indifferent as to whether a company does defense work; they require the same additional return in order to bear increased risk, whether the investment be in defense or commercial companies.

APPENDIX A

WEIGHTED GUIDELINES POLICY

The weighted guidelines policy is contained in DoD FAR Supplement Subpart 15.9. Figure A-1 is DD Form 1547, which shows the weighted guidelines cost categories and the rates assigned to each category.

FIGURE A-1. WEIGHTED GUIDELINES FORMULA

WEIGHTED GUIDELINES PROFIT/FEE OBJECTIVE

1. CONTRACTOR IDENTIFICATION	a. COMPANY NAME			b. DIVISION NAME (If any)	
	c. STREET ADDRESS	d. CITY		e. STATE	f. ZIP CODE
2. WEIGHTED GUIDELINES CATEGORY (Check one) a. ☐ MANUFACTURING b. ☐ RESEARCH AND DEVELOPMENT c. ☐ SERVICES		3. TYPE OF CONTRACT (Ref DAR, See III, Part 4)			
4. BASIC PROCUREMENT INSTRUMENT IDENTIFICATION NO.				5. SPIIN	
a. PURCHASING OFFICE	b. FY	c. TY-PROC-INST CODE	d. PRIIN		

6. WEIGHTED GUIDELINES PROFIT FACTORS (DAR 3-808.4)

PROFIT/FEE FACTOR OR SUBFACTOR (a)	MEASUREMENT BASE (b)	PROFIT WEIGHT RANGES MPS (%) (c)	R&D(%) (d)	SVCS(%) (e)	ASSIGNED WEIGHT (%) (f)	PROFIT/FEE DOLLARS (g)
PART I — CONTRACTOR EFFORT						
7. MATERIAL ACQUISITION						
a. SUBCONTRACTED ITEMS		1 TO 5	1 TO 5	1 TO 5		
b. PURCHASED PARTS		1 TO 4	1 TO 4	1 TO 4		
c. OTHER MATERIAL		1 TO 4	1 TO 4	1 TO 4		
8. ENGINEERING						
a. DIRECT LABOR		9 TO 16	9 TO 16			
b. OVERHEAD		6 TO 9	6 TO 9			
9. MANUFACTURING						
a. DIRECT LABOR		5 TO 9	5 TO 9			
b. OVERHEAD		4 TO 7	4 TO 7			
10. SERVICES						
a. DIRECT LABOR				6 TO 16		
b. OVERHEAD				4 TO 6		
11. OTHER COSTS						
12. GENERAL MGMT — G & A		6 TO 8	6 TO 8	6 TO 8		
13. SUBTOTAL PROFIT/FEE						
14. LESS: ADJUSTMENT FACTOR		30				
15. TOTAL EFFORT						
PART II — CONTRACTOR RISK						
16. COST RISK	(Total from Col b)	6 TO 8	6 TO 7	6 TO 4		
PART III — FACILITIES INVESTMENT						
17. CAPITAL EMPLOYED	(Line 4, DD Form 1861)	16 TO 20				
18. BASIC PROFIT/FEE OBJECTIVE (Items 15 + 16 + 17, Col g)						
PART IV — SPECIAL FACTORS						
19. SPECIAL PROFIT/FEE OBJ	(See DAR 3-808.3(a))					
a. PRODUCTIVITY						
b. INDEPENDENT DEVELOPMENT	(See DAR 3-808.3(b))	1 TO 4	1 TO 4			
c. OTHER	(Total from Item 19)	-5 TO +5	-5 TO +5	-5 TO +5		
d. TOTAL SPECIAL PROFIT/FEE OBJECTIVE						
20. SUBTOTAL PROFIT/FEE OBJECTIVE (Items 18 + 19d, col g)						
PART V — COST OF MONEY OFFSET (Applicable to Research and Development and Services Weighted Guidelines only.)						
21. LESS: FACILITIES CAPITAL COST OF MONEY (DAR 3-808.3(a)(1)(iii))						
22. TOTAL PROFIT/FEE OBJECTIVE (Items 20 - 21, col g)						

DD FORM 1547 PREVIOUS EDITIONS ARE OBSOLETE.

APPENDIX B

CHARACTERISTICS OF DD FORM 1499 DATA BASE

Statistical analysis was conducted with a data base consisting of 5,434 contracts reported on DD Form 1499, "Profit Review Report for Individual Contracts." The contracts were negotiated in 1980, 1981, and 1982, and all used weighted guidelines. Four major contract types are included: firm-fixed-price (FPP), fixed-price incentive (FPI), cost-plus-fixed-fee (CPFF), and cost-plus-incentive-fee (CPIF). Table B-1 summarizes general characteristics of the data. Most of the manufacturing contracts were firm-fixed-price awards; most of the research and development (R&D) and service contracts were of the cost-plus-fixed-fee type. The Air Force awarded a little over half of the contracts in this data base.

APPENDIX E

CASH FLOW MODEL FOR CONTRACT PRICING ANALYSIS[1]

This appendix describes the cash flow model designed to assist in the nalysis of contract pricing policies. The model is designed for use with otus 1-2-3[2] software on IBM and IBM-compatible personal computers. The model s described in terms of output report (line number) in the following sections f this appendix. Model input data and input procedures are included. The ormat of the output report is shown in sample form (Table E-1).

ORE DATA (LINES 1-2)

1. Contractor Investment. This is the time-phased expenditures for acilities acquired by the contractor. Included are any costs normally capi-alized by the contractor (e.g., installation costs). Contractor investment xpenditures are entered directly into the input portion of the spreadsheet, n the columns for the years in which they are incurred; the input values are epeated in the output report. Year 1 is defined as the first year in which a ontractor's capital expenditure occurs. Such expenditures may occur well efore an asset is placed in service. The model allows for timing differences etween expenditures and initial depreciation recovery (capitalization) by an nput for the year the asset is first placed in service. Placing an asset in ervice in year 3, for example, implies that expenditures began in year 1 of he analysis, while capitalization begins in year 3.

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[1]This appendix is adapted from a similar discussion contained in ogistics Management Institute (LMI) Working Note RE301-1, "Discounted Cash low Analysis for Formulating and Evaluating IMIP Industrial Modernization ncentives Program Proposals," January 1984.

[2]Lotus 1-2-3 is a trademark of Lotus Development Corporation.

TABLE D-1. COMPANIES AND SEGMENTS IN CMF FORM SAMPLE (CONTINUED)

CORPORATION	SEGMENT
United Technologies	Hamilton Standard - Environmental & Space
United Technologies	Pratt & Whitney Aircraft Group - Commercial Products
United Technologies	Pratt & Whitney Aircraft Group - Government Products
United Technologies	Pratt & Whitney Aircraft Group - Manufacturing
United Technologies	Pratt & Whitney Aircraft Group - Service Center
United Technologies	Research Center
United Technologies	Sikorsky Aircraft Division
VARIAN	Beverly, MA (Eastern Tube Division)
VARIAN	Microwave Tube Division (Palo Alto)
Westinghouse	Defense and Electronic Systems Center
Westinghouse	Electro-Mechanical Division
Westinghouse	Marine Division
Westinghouse	Oceanic Division
Westinghouse	Research & Development Center
Williams	Williams International Corp.

TABLE D-1. COMPANIES AND SEGMENTS IN CMF FORM SAMPLE (CONTINUED)

CORPORATION	SEGMENT
Rockwell	Collins Communication Systems Division
Rockwell	Collins Government Avionics Division
Rockwell	Missile Systems Division
Rockwell	North American Aircraft Operations
Rockwell	Rocketdyne Division
Rockwell	Space Transport & Systems Group
Sanders	Component Products Group
Sanders	Federal Systems Group
Signal	Garrett Turbine Engine Co.
Singer	Kearfott Division
Singer	Librascope Division
Sperry	Defense Electronics, Clearwater
Sperry	Defense & Space Systems Division
Sperry	Gyroscope Unit
Sperry	Systems Management
Sperry	Univac Defense Systems Division
Sperry	Univac Technical Services Division
SUMMA	Hughes Helicopters
Teledyne	Brown Engineering
Texas Instruments	Corp. Research, Development & Engineering
Texas Instruments	Equipment Group
Textron	Bell Aerospace - Dalmo Victor
Textron	Bell Aerospace - New Orleans
Textron	Bell Aerospace - Niagara Frontier
Textron	Bell Helicopter
Textron	Hydraulic Research (HR Textron, Inc.)
Todd Pacific Shipyards	Los Angeles Division
United Technologies	Hamilton Standard - Aircraft
United Technologies	Hamilton Standard - Electronic Systems

TABLE D-1. COMPANIES AND SEGMENTS IN CMF FORM SAMPLE (CONTINUED)

CORPORATION	SEGMENT
McDonnell-Douglas	Astronautics, Huntington Beach
McDonnell-Douglas	Astronautics, St. Louis
McDonnell-Douglas	Astronautics, Titusville
McDonnell-Douglas	Douglas Aircraft Co.
McDonnell-Douglas	Electronics
McDonnell-Douglas	McDonnell Aircraft Co.
McDonnell-Douglas	Technical Service, H.I.D.
McDonnell-Douglas	Tulsa
Morton-Thiokol	Elkton Division
Morton-Thiokol	Huntsville Division
Morton-Thiokol	Utah Division
Morton-Thiokol	Wasatch Division
Motorola	Government Electronics Division
Northrop	Aircraft Division
Northrop	Defense Systems Division
Northrop	Electro-Mechanical Division
Northrop	Electronics Division
Northrop	Precision Products Division
Northrop	Ventura Division
Northrop	Western Service Dept.
Northrop	Wilcox Electric, Inc.
Northrop	Worldwide Aircraft Services, Inc.
Ogden	Avondale Shipyards, Inc.
RCA	Government Systems - Astroelectronics
RCA	Government Systems - Automated Systems
RCA	Government Systems - Government Communications
RCA	Government Systems - Missile & Surface Radar
Raytheon	Submarine Signal
Rockwell	Collins Air Transport Avionics Division

TABLE D-1. COMPANIES AND SEGMENTS IN CMF FORM SAMPLE (CONTINUED)

CORPORATION	SEGMENT
International Telephone & Telegraph	Aerospace/Optical
International Telephone & Telegraph	Avionics Division
International Telephone & Telegraph	Defense Communications
International Telephone & Telegraph	Electro-Optical Products
International Telephone & Telegraph	Gilfillan
Kaman	Kaman Aerospace
Kaman	Kaman Sciences
Litton	Amecom Division
Litton	Data Systems Division
Litton	Guidance & Control Systems Division
Litton	Ingalls Shipbuilding Division
Lockheed	Lockheed Aircraft Service Co.
Lockheed	Lockheed California Co.
Lockheed	Lockheed Electronics - Denville Division
Lockheed	Lockheed Electronics - Information Engineering
Lockheed	Lockheed Electronics - Systems Division
Lockheed	Lockheed Engineering & Management Services Co.
Lockheed	Lockheed - Georgia
Lockheed	Lockheed Missiles & Space Co.
Magnavox	Advanced Products & Systems Co.
Magnavox	Government & Industrial Electronics - ATRONICS
Magnavox	Government & Industrial Electronics - Mahwah
Magnavox	Government & Industrial Electronics - MESC
Martin-Marietta	Data Systems
Martin-Marietta	Denver Aerospace
Martin-Marietta	Denver Division
Martin-Marietta	Orlando Division

TABLE D-1. COMPANIES AND SEGMENTS IN CMF FORM SAMPLE (CONTINUED)

CORPORATION	SEGMENT
General Electric	Armament Systems
General Electric	Military Electronic Systems
General Electric	Ordnance Systems
General Electric	Simulation and Control Systems
General Electric	Space Systems
General Motors	Delco Electronics
GTE	Communications
GTE	Electronic Systems - Eastern
GTE	Electronic Systems - Federal
GTE	Electronic Systems - Western
General Tire & Rubber	Aerojet General, Electrosystems
General Tire & Rubber	Aerojet General, Liquid Rocket
General Tire & Rubber	Aerojet General, Strategic Propulsion
General Tire & Rubber	Aerojet General, Tactical Systems
Goodyear Aerospace	Akron Defense Systems
Goodyear Aerospace	Centrifuge Equipment Division
Goodyear Aerospace	Engineered Fabrics
Goodyear Aerospace	Litchfield Park
Gould	Navcom Systems
Gould	Ocean Systems
Gould	Systems and Simulation
Grumman	Aerospace
Harris	Government Systems - Melbourne
Harris	Government Support Systems - Syosset
Honeywell	Avionics Systems Group
Honeywell	Defense Systems Division
Honeywell	Electro-Optics Operations
Honeywell	Marine Systems Operations
Honeywell	Systems & Research Center
Honeywell	Tampa Operations
Honeywell	Training & Control Systems

TABLE D-1. COMPANIES AND SEGMENTS IN CMF FORM SAMPLE

CORPORATION	SEGMENT
Aerospace	All
AVCO	Lycoming Division, Stratford
AVCO	Systems Division
Bendix	Communications Division
Bendix	Electrodynamics (inc. Oceanics)
Bendix	EPID, Baltimore
Bendix	Guidance Systems Division
Boeing	Aerospace
Boeing	Computer Services
Boeing	Marine Systems
Boeing	Vertol
Burroughs	SSD
Control Data	Aerospace
Emerson Electric	Electronics & Space
E-Systems	Garland Division
E-Systems	Greenville Division
E-Systems	ECI
E-Systems	Melpar
Fairchild	Republic
Fairchild	Space & Electronics
FMC	Northern Ordnance Division
FMC	Ordnance Engineering Division
FMC	Ordnance Division Operations
General Dynamics	Convair Division
General Dynamics	Electric Boat Division
General Dynamics	Electronics Division
General Dynamics	Ft. Worth Division
General Dynamics	Pomona Division
General Electric	Corporate Research & Development
General Electric	Aerospace Control Systems
General Electric	Aerospace Electronic Systems

APPENDIX D

SEGMENTS IN COST-OF-MONEY FACTORS FORM SAMPLE

Table D-1 consists of an alphabetical list of the 45 companies and 152 associated business segments that appear in the Cost of Money Factors (CMF) form data base. Facilities capital and costs for 1978 and 1982 were compiled for these segments. These companies and segments were the basis for deriving growth rates for facilities capital remaining book value and business base (cost).

indicate capital intensity on DoD contract work. Like the DD Form 1499 data base, the absolute levels of assets and business activity (total sales) are not comparable over time, because the same business segments are not necessarily being measured throughout the period. The ratio of facilities capital to business base is, however, a representative measure of capital intensity.

For Government segments, annual data covering the period 1977 to 1983 were collected on sales, earnings before interest and taxes, total assets, depreciation, and capital expenditures. It was generally not possible to identify fixed assets -- only total assets -- for a segment. These data elements, plus fixed assets by type (land, buildings, machinery, and equipment and other types), were also collected for the company as a whole.

DD FORM 1499

The "Profit Review Report for Individual Contracts" (DD Form 1499) provides information on facilities capital, costs, and prices on a contract-by-contract basis. This form is prepared for contracts that meet established reporting criteria. Not all the same business units or contracts are necessarily represented in the data base every year. Consequently, it would be incorrect to use it to measure the growth rate of total assets, costs, or contract values over a period of years.

These data can legitimately indicate what has happened to the intensity of use of capital on DoD work. The dollar value of facilities capital employed, as well as total contract cost, is reported for every contract in the data base. Consequently, we can compute the ratio of facilities capital per dollar of contract costs. All contracts in the annual data base can be aggregated to determine total facilities capital employed and total contract cost. The ratio of total capital employed to total contract cost yields a dollar weighted value for the annual amount of facilities capital assets per dollar of contract cost. This value should be representative of the application of facilities capital on large DoD contracts.

DFAIR DATA SURVEY

The final source of data was the special survey conducted by Touche Ross & Co. on behalf of the DFAIR study. These data can also be used to

- Additional large segments were added when identified as having large DoD sales. Eighty-five percent of negotiated award dollars were accounted for by 32 companies. The next 32 firms accounted for about an additional 10 percent of negotiated award dollars. Segments from these 32 top firms were included in our data request. The Defense Contract Audit Agency (DCAA) report "Independent Research and Development and Bid and Proposal Cost Incurred by Major Defense Contractors" was used to identify large DoD-oriented segments of these firms.

- Segments were retained in the sample only if most of their sales were to DoD.

- Segments with incomplete data were eliminated -- where labor hours instead of total cost input were the base for allocating G&A or where other data anomalies were found.

- Segments were retained only if they had retrospective "final" reports for both years.

DCAA provided usable final CMF forms for 1978 and 1982 for many of the segments requested. Our final sample consisted of 152 segments representing 45 firms. Appendix D is a listing of firms and segments in the CMF form sample. The segments in the sample had combined assets of over $5 billion and total costs of over $40 billion in 1982.

ANNUAL REPORTS

A second data base was prepared from published annual reports and Form 10-K submissions to the Securities and Exchange Commission (SEC). The universe of firms surveyed by DFAIR was examined to identify publicly traded companies with identifiable Government segments, defined as segments that made at least half of their sales to the Government. In many instances, segments were eliminated because they were identified by characteristics other than customer -- such as product produced or geographic market served. Other companies were eliminated because the proportion of Government sales could not be ascertained. This process yielded a total of 52 usable segments from 46 companies. These companies had combined sales of $153 billion in 1983; of those, $51 billion were made to the Government.

overhead pools to which facilities capital is assigned and the allocation basis for general and administrative (G&A) costs -- usually total cost input. CMF forms are prepared at the outset of an accounting period for forward pricing and often, retrospectively, on the basis of actual accounting values. The CMF form thus represents an audited source of data indicating the stock of facilities capital assigned to a business unit and its associated actual level of activity, measured by the value of the unit's actual total costs. The allocation base used to distribute the segment's G&A expense pool -- which usually coincides with total cost -- is the measure we have selected for the segment's business activity.

CAS 414 permits distribution of G&A on the basis of dollars or direct labor hours. Our study calculates dollar-weighted values for facilities capital and business base; it was therefore necessary to exclude segments where the base for distributing G&A was measured in hours.

The CMF form indicates the level of facilities capital employed per dollar of incurred costs for an entire business unit. Some costs are incurred in support of work for commercial clients. We have operated on the premise that investment decisions are made in response to stimuli from Government business when such business constitutes the majority of a unit's costs or sales. Consequently, our investigation has been confined to business segments that do the majority of their work for the Government.

CMF forms representing a sample of DoD contractors were assembled for our analysis. The forms were the final audited values for the contractors' 1978 and 1982 fiscal years. Segments were selected for inclusion in our sample according to the following criteria:

- The segment was included in a General Accounting Office (GAO) survey of 100 large defense-oriented firms. This survey yielded responses from 58 firms totaling 201 segments.

APPENDIX C

DESCRIPTION OF INVESTMENT DATA BASES

This appendix describes the primary and secondary data bases containing information about facilities capital and business base behavior in the defense industry. The primary source is the Cost of Money Factors (CMF) forms. Secondary sources used were annual company reports, Department of Defense (DoD) DD Form 1499's, and the Defense Finance and Investment Review (DFAIR) survey. Also described here are the procedures used to develop industry samples from these sources.

CMF FORMS

Since 1 October 1976, a contractor's facilities capital has been measured and allocated to contracts in accordance with Cost Accounting Standard (CAS) 414. Facilities capital is measured as the remaining book value of tangible assets plus any intangible capital assets subject to amortization assigned to a business unit or operating division. The assigned facilities capital may be owned assets carried on the books of the business unit, leased property for which constructive costs of ownership are allowed, or the business unit's allocable share of corporate-owned and -leased facilities.

Facilities capital is assigned to a contract for two purposes: to determine the amount of imputed facilities capital cost of money that should be included in contract cost, pursuant to CAS 414, and to determine the base for calculating a component of profit within the weighted guidelines. The CMF form was developed by the Cost Accounting Standards Board (CASB). This form identifies remaining book value of a business unit's facilities capital in total and by overhead pool. The form also indicates the allocation bases for

TABLE B-1. CHARACTERISTICS OF THE DD FORM 1499 DATA BASE (NUMBER OF CONTRACTS)

MANUFACTURING CONTRACTS					
	CONTRACT TYPE				
DEPARTMENT	FFP	FPI	CPFF	CPIF	TOTALS
Army	278	69	116	48	511
Navy	450	55	269	74	848
Air Force	1892	189	131	115	2327
TOTALS	2620	313	516	237	3686

R&D CONTRACTS					
	CONTRACT TYPE				
DEPARTMENT	FFP	FPI	CPFF	CPIF	TOTALS
Army	8	1	249	56	314
Navy	8	0	158	11	177
Air Force	151	72	297	60	580
TOTALS	167	73	704	127	1071

SERVICE CONTRACTS					
	CONTRACT TYPE				
DEPARTMENT	FFP	FPI	CPFF	CPIF	TOTALS
Army	25	0	97	7	129
Navy	59	0	287	6	352
Air Force	133	14	47	2	196
TOTALS	217	14	431	15	677

TABLE E-1. SAMPLE REPORT: DISCOUNTED CASH FLOW MODEL

Year:		1984 1	1985 2	1986 3	1987 4	1988 5	1989 6	1990 7	1991 8
SECTION I. CORE DATA									
1 Contractor Investment		100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2a Cost Savings (w/o depreciation	23.50%	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
2 DoD Benefits		23.5	(3.4)	(17.2)	(12.6)	(8.0)	(3.4)	1.2	5.8
Cumulative Total		23.5	20.1	2.9	(9.6)	(17.6)	(21.0)	(19.8)	(13.9)
SECTION II. INCREMENTAL CASH FLOWS									
3 Contractor Savings on Existing Contract		23.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative Total		23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
4 Cost of Money (CAS 414)	10.00%	0.0	4.4	8.1	6.9	5.6	4.4	3.1	1.9
5 CAS 409 Depreciation		0.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5
6.1 Profit on Facilities Capital	26.80%	0.0	11.7	21.8	18.4	15.1	11.7	8.4	5.0
6.2 Profit on Depreciation	5.00%	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6
6.3 Profit on Savings	-10.00%	0.0	(2.4)	(2.4)	(2.4)	(2.4)	(2.4)	(2.4)	(2.4)
6 Profit Effect		0.0	10.0	20.1	16.7	13.4	10.0	6.7	3.3
7 Subtotal: DoD Cash Flows to Contractor		23.5	26.9	40.7	36.1	31.5	26.9	22.3	17.7
8 Salvage Value		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 Contractor Before-Tax Cash Flow		(76.5)	26.9	40.7	36.1	31.5	26.9	22.3	17.7
Cumulative Total		(76.5)	(49.6)	(8.9)	27.1	58.6	85.5	107.8	125.4
SECTION III. TAX CALCULATIONS									
10 ACRS Depreciation		14.3	20.9	20.0	20.0	20.0	0.0	0.0	0.0
11 Contractor Taxable Income		9.3	6.0	20.7	16.1	11.5	26.9	22.3	17.7
12 Contractor Income Tax	46%	(4.3)	(2.7)	(9.5)	(7.4)	(5.3)	(12.4)	(10.2)	(8.1)
13 Investment Tax Credit	10%	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 Contractor After-Tax Cash Flow		(70.8)	24.1	31.1	28.7	26.2	14.5	12.0	9.5
Cumulative Total		(70.8)	(46.6)	(15.5)	13.2	39.3	53.9	65.9	75.4
SECTION IV. SUMMARY									
15 DoD Program Benefit (W/O I. Cont. Gain)		23.5	(3.4)	(17.2)	(12.6)	(8.0)	(3.4)	1.2	5.8
Cumulative Total	($13.9)	23.5	20.1	2.9	(9.6)	(17.6)	(21.0)	(19.8)	(13.9)
16 DoD Program Benefit (W/ I. Cont. Gain)		0.0	(3.4)	(17.2)	(12.6)	(8.0)	(3.4)	1.2	5.8
Cumulative Total	($37.4)	0.0	(3.4)	(20.6)	(33.1)	(41.1)	(44.5)	(43.3)	(37.4)
17 DoD Payback Period	NA years								
18 Government Benefit		(5.7)	(0.6)	(7.6)	(5.2)	(2.7)	9.0	11.5	14.0
Cumulative Total		(5.7)	(6.4)	(14.0)	(19.2)	(21.8)	(12.9)	(1.4)	12.6
19 Government Payback Period	7.1 years								
20 Contractor Internal Rate of Return (After Tax)									
Without Instant Contract Gain	20.0%								
With Instant Contract Gain	27.4%								
21 Contractor Payback Period (After Tax)	3.5 years								
22 Contractor Internal Rate of Return (Before Tax)									
Without Instant Contract Gain	23.8%								
With Instant Contract Gain	36.1%								
23 Contractor Payback Period (Before Tax)	3.2 years								

Additional investments for facilities placed in service after the initial investment is first capitalized can also be entered in the model's input portion. Investments entered in years after the initial investment is

first capitalized are immediately capitalized in the year the investment is entered in the model.

2a. Cost Savings. Cost savings represent the annual change in allowable contract costs, comparing costs before and after an investment. This definition includes all allowable contract costs except depreciation and imputed cost of money (Cost Accounting Standard (CAS) 414).

Clearly an investment that produces an overall reduction in costs will cause some categories of costs to increase. For example, direct labor may decrease because of an investment in automated machinery, while annual equipment maintenance, insurance, and property tax will likely increase. Changes in direct costs such as manufacturing labor will also cause changes in related indirect costs such as employee benefits.

Cost savings are expressed as a fraction of the value of the contractor investment. This rate is called the "cost reduction rate" in the model's input section. The output will show, for each year, the expected savings as determined by the cost reduction rate.

2. DoD Benefits. Department of Defense (DoD) benefits represent the change in contract price to DoD -- comparing price before and after the investment. Change in contract price is the sum of changes in contract costs and profit. Line 2a gave the change in contract costs excluding depreciation and cost of money. Consequently, the net change in contract price is cost savings of Line 2a less depreciation, cost of money, and any increased profit (plus any reduced profit):

+ Cost Savings (Line 2a)
- CAS 409 Depreciation
- CAS 414 Cost of Money
- Profit Effect (positive profit effect indicates increased contractor profit and conversely)

= DoD Benefits

The model automatically calculates DoD benefits (Line 2) on the basis of information available elsewhere in the model. Depreciation and cost of money are internally calculated once the user selects the depreciation method, service life, and cost of money rate associated with facilities capital. The profit effect is also determined within the model once the user specifies profit rates associated with various determinants of contract profit (see discussion for Lines 6.1 through 6.3).

INCREMENTAL CASH FLOWS (LINES 3-9)

3. Contractor Gain on Existing Contracts. This is the amount of contract cost reduction retained by the contractor on work that had been priced before the investment was put into service. To a large extent, this amount is determined by the contract type. An existing fixed-price contract implies that all cost reduction goes to the contractor. Subsequent contracts are then negotiated on the basis of audited costs so that subsequent gains are taken by the Government. On cost-type contracts, contract cost reductions on existing contracts accrue to DoD, while incentive-type contracts imply sharing of savings on existing contracts.

The contractor gain on existing contracts is user-specified in the input section.

4. Cost of Money (CAS 414). CAS 414 "Imputed Facilities Capital Cost of Money" is included in contract price as an allowable cost (see Federal Acquisition Regulation (FAR) 31.205-10). The payment is an element of contractor cash inflow; since it is an imputed cost, for the contractor there is no corresponding cash outflow. The CAS 414 payment is based on the remaining undepreciated balance (i.e., the net book value) of the facilities investment. For each year, the beginning and ending net book values are averaged to determine the applicable book value. This average book value is then multiplied by the "cost of money rate," supplied by the user as an input, to yield the total

dollar payment for CAS 414. The entire calculation is automatically performed in the model.

5. CAS 409 Depreciation. Annual depreciation expense is an allowable cost on Government contracts under FAR 31.205-11 and is a source of cash inflow to the contractor. Depreciation is the delayed cash inflow that offsets the initial cash outflow incurred to acquire additional facilities. The annual amounts appearing on this line depend on the asset service life and the method of depreciation used. The amounts appearing are generated automatically by the program after selection of service life, the year capitalization begins, and depreciation method for the asset value assumed.

The model allows for selection from among a number of the more common methods of depreciation encountered in practice. This selection is accomplished by entering the number of the selected method and the asset service life in years in the program's input portion. The methods available and a description of the techniques used to generate annual CAS 409 depreciation are as follows:

Method 1. Straight Line: This method assumes an equal amount of depreciation in each year of the asset service life. The annual depreciation amount is given by the formula:

$$\text{Annual Depreciation} = \frac{\text{Cost - Salvage Value}}{\text{Asset Service Life}}$$

Cost is defined as the full asset acquisition cost, including all costs normally capitalized. It is reduced by the estimated salvage value for depreciation purposes, but only if the salvage value is 10 percent or more of the total asset acquisition cost.

Method 2. Sum-of-Years Digits: Annual depreciation is given by the formula:

$$\text{Annual Depreciation} = \frac{\text{Number of Remaining Years Service Life} \times (\text{Cost} - \text{Salvage Value})}{\text{Sum-of-Years Digits Service Life}}$$

The Sum-of-years digits service life is computed by adding the digits of the number of years in the asset service life. For example, if the asset service life is five years, the digits 1 through 5 total 15 (1+2+3+4+5), and the first year's depreciation is one-third (5/15) of the total to be amortized. The depreciation basis is full asset acquisition cost less salvage value. As with Method 1, if salvage value is less than 10 percent of acquisition cost, salvage value is treated as zero for purposes of depreciation calculation.

Method 3. Sum-of-Years Digits with Half-Year Convention: This method applies a Half-year convention to the Sum-of-years digits method. Under it, the annual depreciation amounts are computed exactly as in the Sum-of-years digits described in Method 2; however, the amounts to be depreciated are shifted by one-half year. Thus, in the first year, one-half of the amount computed in Method 2 is allowed. In year 2, the remaining depreciation from year 1 and one-half the Method 2 depreciation amount for year 2 are allowed. This one-half year shift continues until the end of the asset service life. One year after the asset service life ends, the remaining one-half of the Method 2 depreciation amount is taken.

Method 4. 150-Percent Declining Balance: The annual depreciation expense for this method is computed as follows:

$$\text{Annual Depreciation} = (1/\text{Asset Service Life}) \times 1.5 \times (\text{Cost} - \text{Accumulated Depreciation})$$

Under this method, the cost is not reduced by the salvage value in the depreciation calculations; however, the asset is depreciated only down to its salvage value. As with the other methods, salvage value is ignored if it is less than 10 percent of the acquisition cost.

Method 5. 150-Percent Declining Balance with Switchover to Straight Line: This method uses the declining balance described in Method 4. However, a switchover to straight-line depreciation (Method 1) is made at the point at which the declining balance depreciation amount becomes less than that which would be allowed under the straight-line method. Again, depreciation is not allowed below the salvage value, and salvage value is ignored for values less than 10 percent of the acquisition cost.

6. Profit Effect. The contractor's total profit effect reflects the fact that an investment results in profit dollars that vary from what would have been negotiated with the old method of production. Profit increases because higher levels of facilities capital directly bear profit in the weighted guidelines. Profit also increases because of higher levels of depreciation, since depreciation is a part of contractor effort. Profit declines to the extent that an investment lowers contractor effort.

The model automatically calculates each of the three elements of the profit effect and their sum, total profit effect. The user must supply profit rates applicable to each element: (6.1) profit on facilities capital, (6.2) profit on depreciation, and (6.3) lost profit on cost savings. Note that profit on cost savings is treated by convention as a negative, reduced profit to the contractor.

7. Subtotal: DoD Cash Flows to Contractor. This subtotal represents the before-tax cash flow to the contractor from DoD arising from the contractor's facilities investment. Cash flow from DoD to the contractor is

the sum of the instant contract gain (Line 3), CAS 414 imputed facilities capital cost of money (Line 4), CAS 409 depreciation on additional facilities capital (Line 5), and the profit effect (positive or negative) given by Line 6. The DoD cash flows to the contractor represent the additional cash flow stream to the contractor arising from the investment and its effects on contract price. Cash flow from DoD to the contractor is calculated automatically by the program.

8. Salvage Value. Salvage value represents an anticipated cash inflow to the contractor at the end of the investment's estimated service life. Salvage value, if significant, may be entered in the model's input portion for the last year of the asset's depreciable service life.

9. Contractor Before-Tax Cash Flow. Before-tax cash flow to the contractor is the difference between all cash outflows and all cash inflows to the contractor. Cash outflows are contractor investment (Line 1). Cash inflows are given by DoD cash flows to the contractor (Line 7) and salvage value (Line 8). Annual contractor before-tax cash flow is then the sum of Lines 1, 7, and 8, where outflows are treated as negative values and inflows are positive.

Contractor before-tax cash flow is automatically calculated by the model. The sign of the annual value denotes whether the contractor enjoys a net inflow (positive) or outflow (negative). Generally, contractor before-tax cash flow is negative (an outflow) in the early years of the analysis, as a result of the facilities acquisitions. The cash flow stream usually turns positive (a net inflow) following the facilities acquisition and remains positive for a number of years. A net outflow may reoccur when the undepreciated book value of the assets declines to a low value and depreciation, CAS 414 payments, and weighted guidelines profit on facilities capital employed are concomitantly low.

TAX CALCULATIONS (LINES 10-14)

The objective of the next five lines is to calculate the contractor's Federal income tax consequences arising from the investment. Once tax liability is determined, contractor after-tax cash flow can be determined as the difference between before-tax cash flow and the incremental tax consequences of the investment.

10. Accelerated Cost Recovery System (ACRS) Depreciation. Additional contractor net cash revenues (i.e., contract sales dollars) are subject to Federal income taxes. Under tax law, the contractor is allowed to deduct depreciation charges from additional net cash revenues, using ACRS depreciation guidelines. Additional contractor net cash revenues, less ACRS depreciation charges, determines the incremental income subject to Federal income taxes. ACRS tax depreciation generally differs from CAS 409 cost principles depreciation. Under tax conventions, the depreciable basis to which ACRS depreciation is applied is reduced to 95 percent of the capitalized value of the investment. This treatment reflects the convention applicable under tax code when a 10-percent investment tax credit is taken. If a reduced investment tax credit is taken, the depreciable basis for ACRS depreciation is 100 percent of the asset's capitalized acquisition value.

The annual ACRS tax depreciation charges appearing on Line 10 are generated by the program on the basis of the value of the contractor's investment (Line 1) and the ACRS tax depreciation method selected. The user selects the ACRS method from the two available methods (standard tables or straight line) displayed in the input section. The user must also specify the asset service life (called cost recovery class) applicable to ACRS tax depreciation. The user also specifies the year that the asset is placed in service for ACRS depreciation purposes. The available ACRS methods are described below.

Method 1. Standard ACRS Tables for Three-, Five-, and Ten-Year Cost-Recovery Classes: This method uses rates provided by standard Internal Revenue Service tables for the various cost-recovery classes. The rates in these tables are applied to the full acquisition cost. If a full investment credit is taken for the particular class (10 percent for five- and ten-year and 6 percent for three-year), the depreciation base is reduced by one-half the investment credit taken. Salvage value is ignored under this method.

Method 2. Straight-Line: In lieu of the standard ACRS depreciation allowances, the user may instead select straight-line depreciation method, in which the annual depreciation allowances are computed according to the specified asset service life without regard to salvage value.

11. Contractor Taxable Income. Income subject to Federal income tax is the difference between the contractor's additional net cash revenues and ACRS tax depreciation charges. Additional net cash revenues associated with the facilities investment are DoD Cash Flows to Contractor (Line 7) plus Salvage Value (Line 8). Taxable income in Line 11 is thus additional net cash revenues (Line 7 plus Line 8) minus ACRS depreciation charges (Line 10). Taxable income is computed automatically by the model for each year covered by the analysis.

12. Contractor Income Tax. Income subject to Federal income tax, given by Line 11, times the contractor's applicable Federal income tax rate, determines the dollar value of the Federal income tax liability. The tax rate used should be that applicable to additional taxable income; i.e., the contractor's marginal Federal income tax bracket. Generally, this will be 46 percent, although other rates can be used if appropriate. This procedure assumes that the Federal income tax liability is paid in the year in which it accrues. If the contractor defers the liability under the "Completed Contract Method," the

cash outflow for Federal income taxes is postponed until contract completion. To allow for this possibility, a user-specified lag has been introduced into the model. The user specifies the number of years by which the cash outflow for income taxes lags behind the accrued tax liability. A two-year lag, for example, means that the tax liability for income of year 1 is paid in year 3, the liability for year 2 is paid in year 4, and so on. All unpaid taxes are assumed paid in the final year of the analysis. Finally, note that income tax refers only to Federal income taxes; state, local, and other taxes are allowable costs and are generally reimbursed as indirect costs (see FAR 31.205-41).

13. Investment Tax Credit. An investment tax credit is added to contractor cash inflow or, equivalently, subtracted from the contractor's tax liability, to reflect the investment tax credit applicable under tax law. The credit is generally calculated using 10 percent of the asset's capitalized acquisition value and credited when the asset is first placed in service. A 6-percent credit applicable to assets in a three-year cost recovery class is also possible. The model automatically applies a 10-percent investment tax credit for the year the asset is placed in service and capitalized. The 10-percent credit is applied to the cumulative value of Line 1 investment up to the time the asset is placed in service. In the model, the user can override the 10-percent credit with another value (e.g., the 6 percent applicable to the three-year cost recovery class). User input for the investment tax credit percentage is described in the input portion.

14. Contractor After-Tax Cash Flow. This stream represents the incremental net cash flow accruing to the contractor as a result of the investment. This stream is the one representing the financial outcome of the contractor's investment and the one from which an internal rate of return (IRR) is computed. After-tax cash flow is computed by subtracting contractor income

taxes, adjusted for any investment tax credit, from before-tax cash flow. Thus, the contractor's after-tax cash flow (Line 14) is the sum of Lines 9, 12, and 13, where a positive value reflects a cash inflow and a negative value a cash outflow.

SUMMARY (LINES 15-23)

The summary begins with DoD and Government benefits; a year-by-year tracking of costs and benefits arising from the contractor investment. Benefits to DoD are those listed in Line 2, Net Savings Available to DoD. These benefits were calculated as the potential contract price change before any contractor gain on the instant contract (Line 3). The DoD Program Benefit is equal to Line 2, less any contractor gain on the instant contract (Line 3). Under this definition, a positive value indicates a net benefit to DoD (i.e., price reduction in excess of instant contract gain), while a negative value indicates a cost to DoD. The Government benefit reflects tax recoupment by the Government and thus generally exceeds DoD Program Benefit.

15-16. DoD Program Benefit. DoD Program Benefit represents the annual net benefit, if positive, or cost, if negative, from an investment. This value is the difference between the annual price reductions anticipated from the investment (DoD Benefits, Line 2) less any contractor gain on the instant contract (Line 3). Typically, DoD Program Benefit is negative (i.e., a cost) in early years of the analysis, when funding and cash flow payments by DoD to the contractor are at their high levels. Line 15 gives DoD Program Benefit when the contractor gain on the instant contract is set at zero. Line 16 shows DoD Program Benefit after deduction of the contractor gain on the instant contract, if any.

17. DoD Payback Period. DoD and Government returns are indicated by payback periods: the number of years from the time benefits are first

negative until they become positive. Payback is a particular representation of return where discounting is not performed and the value of benefits and costs beyond the payback period is not considered. Payback period represents the time required to match DoD-incurred costs with benefits. DoD benefits are likely to be negative (i.e., costs) during the early period of the analysis, since costs such as depreciation and CAS 414 payments are at their highest level during that period. The model automatically computes the DoD payback period using DoD Program Benefit (Line 16). Payback period is computed as the amount of time the cumulative value of Line 16 is negative.

18. Government Benefit. This value is found by adding the contractor's tax payment, less any investment tax credit, to the net DoD Program Benefit. Generally, Government Benefit exceeds DoD Program Benefit and thus the Government payback period is shorter than the DoD payback period. The model automatically computes Line 18, Government Benefit, by adding Contractor Income Tax (Line 12) to DoD Program Benefit (Line 16) and deducting Investment Tax Credit (Line 13). Thus, the contractor gain on the existing contract is always considered in the calculation of Government Benefit.

19. Government Payback Period. This measure of return to the Government is calculated on the basis of the Line 18 benefit/cost stream. It represents the time required for the Government to recoup, in the form of benefits, all Government cost incurred for the project. The model automatically computes the Government payback period by considering the amount of time the cumulative totals of Line 18 are negative.

20. Contractor After-Tax (IRR). The contractor IRR is based on the after-tax cash flow stream reported in Line 14. The IRR associated with this cash flow represents that rate which equates the present value of cash inflow to the present value of cash outflow. Since Line 14 is net cash flow, a

negative entry in any one year represents a net cash outflow and, conversely, when the entry is positive, a net cash inflow is represented.

Two IRRs are computed in the model: one rate considering the after-tax cash flow exclusive of any instant contract gain and the other including any instant contract gain. The IRR is computed by a built-in routine in the spreadsheet program.

21. Contractor After-Tax Payback Period. In addition to IRR as a measure of the financial outcome of the contractor investment, a payback period computation is included in the model. Payback period tells the contractor the number of years required to recoup his investment-related cash outflow. As with any payback computation, the time value of money (i.e., discounting) and the value of benefits beyond the payback period are not considered. Contractor payback includes any instant contract gain and represents the number of years from the point at which the cumulative after-tax cash flow is first negative to the time when it becomes positive.

22. Contractor Before-Tax IRR. This line reports the contractor IRR based on before-tax cash flow on Line 9. Again, two IRRs are computed; one without instant contract gains and the other with any instant contract gains.

23. Contractor Before-Tax Payback Period. This is the payback period including any instant contract gains.

MODEL INPUTS AND CONVENTIONS

A complete run of the model is accomplished by specifying a number of inputs. These inputs may take the form of annual values, single rates, or integer values denoting accounting methods or conventions used in the model. Inputs and conventions of the model are described below:

1. Number of Years of Analysis. The user selects the number of years of display desired at the outset of the analysis, by pressing the "ALT" and

' keys simultaneously. The user is then asked to specify the number of ırs desired (a value between 2 and 15). The program automatically adds the ɜired number of columns.

2. Inputs of Annual Values. Annual values are required for ven variables. The annual values for these variables are entered in the ıel input section and then are automatically reproduced in the appropriate ıes of the Discounted Cash Flow Model output report. The following sign ıventions apply to these values:

Annual Values

- Contractor Investment - positive or zero and entered in the year corresponding to when the contractor's cash expenditures occur.
- Cost Reduction Rate - The reduction in contract costs entered as a percentage of the total facilities capital cost.
- Contractor Gain on Instant Contract - The dollar value of the contract cost reduction that is kept by the contractor. Instant contract gains may occur over a number of years since the instant contract may be performed over a number of years.
- Profit on Facilities Capital - Positive or zero percentage rate.
- Profit on Depreciation - Positive or zero percentage rate.
- Profit on Savings - Entered as a negative or zero percentage rate.
- Salvage Value - positive or zero.

Rates and Accounting Conventions.

- CAS 414 Rate - decimal equivalent; e.g., 11.5 percent entered as 0.115.
- CAS 409 Depreciation Method - an integer between 1 and 5, corresponding to the method selected.
- Asset Service Life - an integer equal to the numbe of years of asset service life assumed.
- Year Placed into Service - an integer value corresponding to the year the asset is first placed in service and CAS 409 depreciation begins.

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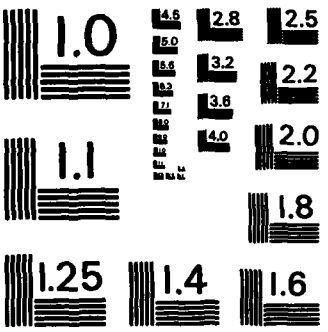

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- ACRS Depreciation Method - an integer corresponding to the method selected (1 or 2).

- Asset Class for ACRS - an integer corresponding to possible ACRS service life; 3, 5, or 10 for ACRS Method 1 but an integer specifying the asset service life for ACRS Method 2.

- Contractor Tax Rate - marginal Federal income tax rate entered as the decimal equivalent, such as 0.46.

- Investment Tax Credit Rate - a percentage rate, generally 10 percent, entered as the decimal equivalent; e.g., 0.1.

- Completed-Contract Tax Lag - an integer value representing the lag in years between the year in which the tax liability accrues and when it is paid (0 implies no lag).

- Profit rates - percentages entered as decimal equivalents.

APPENDIX F

COMPANIES IN RISK ANALYSIS SAMPLE

This attachment lists the 214 companies in the sample compiled for the analysis of risk conducted in Chapter 5. Companies and data are drawn from the Standard and Poor's COMPUTSTAT Services' data base. For each company, the group to which it has been assigned and the measures of return and risk calculated are listed. Group, return, and risk variables are defined as follows:

- D1 is the group indicator, where 0 = commercial, 1 = low defense, 2 = medium defense, and 3 = high defense;
- MRTASS = mean net income return on assets;
- SDASS = standard deviation of mean net income return on assets;
- MRTEQ = mean net income return on equity;
- SDEQ = standard deviation of mean net income return on equity;
- MRTSLS = mean net income return on sales;
- SDSLS = standard deviation of mean net income return on sales;
- MMKT = mean market return; and
- SDMKT = standard deviation of mean market return.

OBS	NAME	DI	MRTASS	SDASS	MRTEQ	SDEQ	MRTSLS	SDSLS	MMKT	SDMKT
1	ALLIANCE TIRE & RUBBER CO-A	0							0.254425	0.73847
2	ARMSTRONG RUBBER	0	0.03451	0.036884	0.07858	0.09395	0.02184	0.016749	0.134912	0.33543
3	BANDAG INC	0	0.14074	0.020720	0.18901	0.03018	0.11567	0.012931	0.220615	0.46284
4	CARLISLE CORP	0	0.09717	0.037272	0.17418	0.06520	0.05440	0.033378	0.295538	0.47741
5	COOPER TIRE & RUBBER	0	0.04085	0.024807	0.17505	0.05121	0.03395	0.042799	0.251921	0.59324
6	DAYCO CORP	0	0.01473	0.020849	0.04821	0.06594	0.01616	0.098703	0.107264	0.34245
7	DUNLOP HOLDINGS PLC	0							0.011483	0.44940
8	FIRESTONE TIRE & RUBBER CO	0	0.01979	0.034582	0.04052	0.07632	0.01421	0.510811	0.066145	0.27887
9	PLYMOUTH RUBBER CO-CL A	0	-0.02218	0.051282	-0.04118	0.10725	-0.01118	0.477851	-0.026842	0.33434
10	UNIROYAL INC	0	0.00486	0.035477	0.01068	0.10835	0.00525	0.433564	0.040592	0.30604
11	WELLCO ENTERPRISES	0	-0.04603	0.190751	-0.10249	0.47973	-0.03032	0.889843	-0.005639	0.31893
12	AMERICAN CAN CO	0	0.03356	0.030860	0.07972	0.08800	0.02179	0.022291	0.076469	0.19003
13	CROWN CORK & SEAL CO INC	0	0.07454	0.012380	0.12749	0.02782	0.04454	0.355295	0.093159	0.17496
14	NATIONAL CAN CORP	0	0.03953	0.014886	0.10889	0.04595	0.02230	0.009945	0.124664	0.28529
15	ORMAND INDUSTRIES	0	0.02737	0.025402	0.03450	0.04378	0.02291	0.017495	0.104496	0.70387
16	VAN DORN CO	0	0.04687	0.018320	0.12879	0.03636	0.03529	0.468042	0.216143	0.46853
17	ALLIED PRODUCTS	0	-0.00134	0.023778	-0.00013	0.07372	-0.00093	0.073646	0.110984	0.49062
18	ARTRA GROUP INC	0	-0.02319	0.100547	-0.08218	0.25771	-0.03004	0.515161	0.221190	0.75141
19	GENERAL HOUSEWARES	0	0.07928	0.021201	0.20816	0.04434	0.04143	0.007109	0.313713	0.77454
20	HOWELL INDUSTRIES INC	0	0.02820	0.065240	0.01379	0.11330	0.02289	0.871481	0.226265	0.82814
21	PENTRON INDUSTRIES	0	-0.13716	0.149333	-0.09398	2.26474	-0.07168	0.558723	0.065149	0.49174
22	REDLAW INDUSTRIES INC	0							0.190595	0.51083
23	SIFCO INDUSTRIES	0	0.04682	0.036425	0.08053	0.06292	0.03844	0.075380	0.205432	0.47876
24	WALCO NATIONAL CORP	0	0.06797	0.057969	0.12254	0.10442	0.04548	0.293398	0.110148	0.31145
25	ZERO CORP	0	0.10095	0.014469	0.18187	0.01822	0.07362	0.028387	0.362344	0.53444
26	ANDERSON, GREENWOOD & CO	0	0.08019	0.028114	0.14929	0.05580	0.07343	0.397717	0.253164	0.38987
27	AUTOMATIC SWITCH	0	0.12945	0.020954			0.10737	0.032042	0.215334	0.35396
28	CORE INDUSTRIES INC	0	0.10816	0.023844	0.15599	0.03734	0.07149	0.068728	0.276044	0.62709
29	CUSTOM ENERGY SERVICES INC	0	0.00130	0.001578	-0.14718	0.43044	-0.01153	0.461471	0.323544	1.11814
30	KEYSTONE INTERNATIONAL	0	0.14574	0.034503	0.24181	0.05538	0.13555	0.107678	0.340904	0.50180
31	BRIGGS & STRATTON	0	0.12282	0.035330	0.17158	0.04714	0.06679	0.056072	0.128402	0.26571
32	BRUNSWICK CORP	0	0.09231	0.076544	0.17403	0.16048	0.06457	0.439516	0.235085	0.53519
33	CUMMINS ENGINE	0	0.03985	0.037236	0.09960	0.09231	0.02748	0.034895	0.144941	0.45407
34	OUTBOARD MARINE CORP	0	0.04586	0.026053	0.08744	0.04741	0.03780	0.446511	0.208184	0.54058
35	ALLIS-CHALMERS CORP	0	-0.01784	0.094151	-0.07577	0.27716	-0.01357	0.508819	0.042046	0.50495
36	COOPER INDUSTRIES INC	0	0.08546	0.024096	0.16004	0.04767	0.07151	0.022476	0.203162	0.45601
37	DOVER CORP	0	0.14023	0.017040	0.20323	0.02515	0.08355	0.012935	0.248245	0.39385
38	HARNISCHFEGER CORP	0	0.00485	0.075971	-0.00408	0.23283	0.00042	0.063876	0.078944	0.34624
39	JOY MFG CO	0	0.07165	0.030042	0.12158	0.04842	0.06526	0.431709	0.133239	0.36276
40	NATIONAL MINE SERVICE CO	0	0.01793	0.060250	0.02407	0.11465	0.02755	0.054985	0.116131	0.39754
41	CONTINENTAL MATERIALS CORP	0	0.04816	0.024719	0.07695	0.05004	0.02987	0.017918	0.246520	0.70988
42	FEDDERS CORP	0	-0.12221	0.259465			-0.18500	0.480006	0.234145	0.83144
43	LSB INDUSTRIES INC	0	0.00305	0.052611	-0.20703	0.43951	-0.00422	0.051265	0.053734	0.41167
44	TECUMSEH PRODUCTS CO	0	0.11807	0.026558	0.15051	0.03278	0.06022	0.457234	0.172024	0.35739
45	TOKHEIM CORP	0	0.09479	0.016508	0.16085	0.05111	0.05934	0.269875	0.361782	0.46559
46	VENDO CO	0	-0.05825	0.138073	-0.24909	0.56773	-0.03735	0.483256	0.051159	0.76068
47	AEROFLEX LABORATORIES INC	0	0.10820	0.018532	0.20804	0.03919	0.07607	0.086033	0.251140	0.77485
48	NORTH AMERICAN PHILIPS CORP	0	0.05272	0.008910	0.12533	0.01899	0.03469	0.447309	0.148432	0.36431
49	ALLEGHENY INTERNATIONAL INC	0	0.03279	0.014228	0.13824	0.04363	0.04214	0.101928	0.086354	0.37403
50	CASABLANCA INDS INC	0	0.03517	0.044562	0.10557	0.19466	1.49558	0.106513	0.094612	0.51710
51	CONAIR CORP	0	0.04881	0.040017	0.15033	0.14421	0.04611	0.070060	0.538024	0.88103
52	DYNAMICS CORP OF AMERICA	0	0.20051	0.239546	0.13516	0.07124	0.09908	0.087054	0.531529	1.95524
53	HEALTH-MOR INC	0	0.13547	0.043172	0.17288	0.04051	0.09424	0.024207	0.184028	0.35822
54	HOOVER CO	0	0.02810	0.038215	0.04919	0.08459	0.01759	0.458283	0.193741	0.43469
55	MAGIC CHEF INC	0	0.04638	0.033062	0.10471	0.04718	0.02755	0.074715	0.303484	0.55098
56	MAYTAG CO	0	0.18702	0.033504			0.10546	0.094418	0.153228	0.33034

OBS	NAME	DI	MRTASS	SDASS	MRTEQ	SDEQ	MRTSLS	SDSLS	MMKT	SDMKT
57	NATIONAL PRESTO INDS INC	0	0.1041	0.02836	0.12740	0.03935	0.128021	0.385933	0.30870	0.66169
58	REECE CORP	0	0.0159	0.04367	0.01394	0.07560	0.019686	0.441380	0.10443	0.39146
59	SCOVILL INC	0	0.0461	0.02573	0.10561	0.04787	0.032690	0.090681	0.15675	0.32904
60	WHIRLPOOL CORP	0	0.0970	0.02544	0.15131	0.03560	0.048761	0.422323	0.15382	0.33244
61	WHITE CONSOLIDATED INDS INC	0	0.0307	0.01111	0.14443	0.05965	0.032177	0.068562	0.19035	0.46534
62	ALTEC CORP	0	-0.0443	0.05962	0.10438	0.20645	-0.047416	0.077071	0.13693	1.11709
63	CRAIG CORP	0	-0.1147	0.14543	-0.17558	0.22415	-0.053389	0.579049	0.15927	1.00270
64	EMERSON RADIO	0	0.0487	0.05422	0.10359	0.11535	0.020483	0.435604	0.73160	1.26113
65	ESQUIRE RADIO & ELECTRON INC	0	0.0841	0.01516			0.036001	0.021892	0.24398	0.55962
66	GULTON INDUSTRIES INC	0	0.0431	0.02209	0.08937	0.04398	0.024575	0.510396	0.19622	0.44489
67	ODETICS INC-CL B	0	0.0459	0.04478	0.17718	0.13794	0.038088	0.043782	0.06029	0.39686
68	WARNER COMMUNICATIONS INC	0	0.0529	0.07160	0.13424	0.21318	0.049104	0.459617	0.22492	0.52135
69	WELLS-GARDNER ELECTRONICS	0	0.0305	0.30376	0.05354	0.51885	-0.016064	0.156977	0.35361	1.24920
70	ZENITH ELECTRONICS CORP	0	0.0238	0.03687	0.04858	0.08251	0.013103	0.438271	0.11726	0.40889
71	ACTON CORP	0	0.0195	0.05324	0.04869	0.39749	0.113663	0.388947	0.27630	0.80320
73	LYNCH COMMUNICATION SYSTEM	0	0.0271	0.05554	0.02621	0.12445	0.029195	0.061036	0.25586	0.60426
74	MITEL CORP	0							-0.13757	0.57416
75	PLANTRONICS INC	0	0.1148	0.04445	0.16012	0.05360	0.099134	0.409146	0.37027	1.06660
76	PLESSEY PLC	0							0.26922	0.56828
77	PORTA SYSTEMS CORP	0	0.0838	0.04139	0.14568	0.10460	0.060945	0.204172	0.56522	1.52873
78	TIE/COMMUNICATIONS INC	0	0.0720	0.03382	0.22916	0.10214	0.047895	0.051683	0.72513	0.98407
79	TELECONCEPTS CORP	0	0.0954	0.07847	0.20317	0.18674	0.044486	0.461373	0.77496	1.71265
80	TELESCIENCES INC	0	0.0528	0.13608			0.040733	0.180160	0.19907	0.51120
81	TRANS-LUX CORP	0	0.0772	0.02679	0.10622	0.03465	0.067266	0.050834	0.18372	0.55853
82	WEBCOR ELECTRONICS INC	0	0.0320	0.11858	0.06179	0.29259	0.011378	0.480966	0.28816	0.69036
83	ANDREA RADIO CORP	0	0.0959	0.01917	0.07836	0.03989	0.076734	0.064013	0.11962	0.44385
84	ANDREW CORP	0	0.0762	0.01314	0.15782	0.01484	0.083584	0.018563	0.27066	0.32953
85	AUDIOTRONICS CORP	0	0.0468	0.04468	0.11188	0.07544	0.035577	0.053507	0.14387	0.54794
86	AYDIN CORP	0	0.1028	0.01871	0.23029	0.04951	0.068819	0.076429	0.30671	1.31137
87	BARNES ENGINEERING CO	0	-0.0893	0.24605	-0.15892	1.83244	-0.065659	0.567956	-0.04067	0.37262
88	ELECTROSPACE SYSTEMS INC	0	0.1357	0.00950	0.31505	0.03410	0.074228	0.023136	1.01787	1.06165
89	FEDERAL SIGNAL CORP	0	0.0771	0.02435	0.15508	0.03999	0.056155	0.025887	0.27028	0.60639
90	GENERAL DATACOMM INDS INC	0	0.0581	0.03773	0.15488	0.10815	0.051114	0.041934	0.08719	1.03631
91	INSTRUMENT SYSTEMS CORP	0	-0.0448	0.10781			-0.042910	0.459801	-0.17637	0.34408
92	KING RADIO CORP	0	0.0869	0.04851	0.12411	0.09618	0.051735	0.078431	0.21904	0.60658
93	KNOGO CORP	0	0.0461	0.04680	0.04247	0.10574	0.065871	0.346077	0.67138	0.90063
94	LA POINTE INDUSTRIES	0	-0.0299	0.10842			-0.019123	0.091147	0.22979	0.77199
95	OAK INDUSTRIES INC	0	-0.0083	0.12751	-0.12033	0.63457	-0.013126	0.112970	0.15501	0.64234
96	PARADYNE CORP	0	0.0748	0.04124	0.13208	0.06122	0.103004	0.051870	0.57945	1.05240
97	PENRIL CORP	0	0.0835	0.03969			0.073223	0.036977	0.31439	0.59724
98	PICO PRODUCTS INC	0	0.1236	0.11339	0.57280	0.99269	0.038904	0.407497	-0.15335	0.44852
99	PITTWAY CORP	0	0.1238	0.02825	0.17042	0.04394	0.089435	0.039438	0.23812	0.51676
100	RMS ELECTRONICS INC	0	0.0498	0.04560	0.15264	0.13376	0.029127	0.489487	-0.28339	0.23676
101	SCIENTIFIC-ATLANTA INC	0	0.0441	0.02830	0.12244	0.05446	0.044098	0.047322	0.27122	0.72523
102	SERVO CORP OF AMERICA	0	0.0182	0.04841			0.017389	0.080599	0.12092	0.53224
103	STEWART-WARNER CORP	0	0.0748	0.02711	0.10411	0.03975	0.051024	0.031545	0.11353	0.26968
104	SUNAIR ELECTRONICS INC	0	0.1325	0.02058	0.14497	0.02412	0.170595	0.040213	0.24018	0.58013
105	TECH-SYM CORP	0	0.0778	0.03199	0.12211	0.04282	0.058557	0.471054	0.28531	0.61338
106	TEXSCAN CORP	0	0.0437	0.03422	0.11601	0.03441	0.047739	0.463328	0.49334	1.21920
107	TIMEPLEX INC	0	0.0729	0.03610	0.13266	0.07234	0.045839	0.059517	0.44412	1.03755
108	TOROTEL INC	0	0.0380	0.05547	0.03551	0.10904	0.033758	0.491970	0.11049	0.21930
109	VICON INDUSTRIES INC	0	0.0855	0.02786	0.14985	0.05768	0.057232	0.028935	0.34173	0.49396
110	CLAROSTAT MANUF CO INC	0	0.0499	0.02095	0.08372	0.02856	0.038450	0.022536	0.13572	0.42815
111	GENERAL INSTRUMENT CORP	0	0.0731	0.03808	0.12201	0.05090	0.058592	0.035533	0.20575	0.55409
112	RIBLET PRODUCTS CORP	0	0.0241	0.04429	0.04134	0.09780	0.009506	0.024785	0.14715	0.66244

OBS	NAME	DI	MRTASS	SDASS	MRTEQ	SDEQ	MRTSLS	SDSLS	MMKT	SDMKT
113	BORG-WARNER CORP	0	0.063681	0.014476	0.11430	0.02598	0.04548	0.012788	0.16731	0.31338
114	DANA CORP	0	0.072365	0.024299	0.13810	0.04468	0.04932	0.053931	0.17571	0.41126
115	DYNEER CORP	0	0.059810	0.017334	0.12762	0.04247	0.03786	0.098983	0.17181	0.39817
116	ECHLIN INC	0	0.076424	0.023769	0.13964	0.04578	0.05531	0.024641	0.19656	0.34397
117	FACET ENTERPRISES	0	0.011206	0.041224	0.01845	0.09702	0.00741	0.490350	0.15296	0.46761
118	FRUEHAUF CORP	0	0.027838	0.025300	0.08169	0.07440	0.01862	0.024255	0.10582	0.32816
119	HASTINGS MFG CO	0	0.062358	0.006588			0.03629	0.011731	0.19022	0.33261
120	HINDERLITER INDS INC	0	0.021056	0.050502	0.10762	0.21163	0.00712	0.426428	-0.09533	0.37187
121	KYSOR INDUSTRIAL CORP	0	0.042108	0.041496	0.08679	0.07869	0.03161	0.504173	0.29300	0.76834
122	RAYMARK CORP	0	-0.055629	0.108166	-0.15873	0.26277	-0.03910	0.515342	0.03351	0.28411
123	SHELLER-GLOBE	0	0.035199	0.045496	0.07514	0.10498	0.02084	0.018247	0.21555	0.61738
124	SMITH (A O) CORP-CL A	0	0.020050	0.037636	0.03879	0.07529	0.00930	0.033372	0.15492	0.53650
125	STANDARD PRODUCTS CO	0	0.048340	0.047718	0.13481	0.09264	0.03049	0.031144	0.33489	0.67910
126	SUPERIOR INDUSTRIES INTL	0	0.031287	0.076183	0.05989	0.17848	0.01379	0.123424	0.35178	0.87747
127	TRANSWAY INTERNATIONAL CORP	0	0.075031	0.024004	0.13394	0.04990	0.03226	0.431043	0.11152	0.29387
128	WEDTECH CORP	0	0.068205	0.092593	0.84188	0.82452	0.07793	0.443194	-0.37805	
129	WYNN'S INTERNATIONAL INC	0	0.045193	0.051299	0.08605	0.09579	0.03838	0.469799	0.14012	0.35929
130	WALBAR INC	0	0.147443	0.024380	0.25150	0.04685	0.10862	0.034863	0.19748	0.47412
131	GULFSTREAM AEROSPACE CORP	0	0.077125	0.040770	0.41173	0.15124	0.06528	0.039379	-0.12672	
132	MACRODYNE INDS	0	-0.041431	0.119320	-0.91656	3.13983	-0.12844	0.052224	0.58572	2.46412
133	OEA INC	0	0.070216	0.062395	0.18969	0.09652	0.06327	0.369844	0.23138	0.47312
134	SIERRACIN CORP	0	0.063806	0.043681	0.12201	0.10508	0.03916	0.373987	0.37298	0.85749
135	TELEFLEX INC	0	0.076550	0.037759	0.15837	0.07344	0.05002	0.028657	0.32247	0.56971
136	UNITED AIRCRAFT PRODUCTS INC	0	0.120998	0.023455	0.15806	0.03085	0.09483	0.089350	0.25242	0.59846
137	AMERICAN SHIP BUILDING CO	0	0.045011	0.070344	0.10019	0.15531	0.02535	0.488947	0.21035	0.52758
138	TACOMA BOATBUILDING INC	0	0.023064	0.070907	-0.01868	0.74051	-0.00790	0.111440	-0.11808	0.51816
139	GELMAN SCIENCES INC	0	0.062813	0.045597	0.14589	0.11224	0.05088	0.219418	0.19747	0.76183
140	HEINICKE INSTRUMENTS	0	0.091745	0.011748	0.13971	0.03084	0.10872	0.114609	0.14959	0.60727
141	MARK PRODUCTS INC	0	0.045199	0.162384	0.21744	0.17215	0.04451	0.113443	0.48777	1.04881
142	SPECTRA-PHYSICS	0	0.051455	0.060900	0.07817	0.10381	0.04283	0.048782	0.43412	1.06255
143	USR INDUSTRIES INC	0	-0.011159	0.071802	-0.00479	0.08930	-0.01896	0.518755	0.08432	0.63480
144	BELL & HOWELL CO	0	0.025538	0.068400	0.05749	0.13121	0.01957	0.011225	0.09414	0.43181
145	COMPUGRAPHIC CORP	0	0.039911	0.048181	0.07382	0.10077	0.03049	0.047855	0.33884	0.79755
146	MATRIX CORP-N J	0	0.044629	0.082525	0.00904	0.37644	0.04927	0.384465	0.44077	0.87294
147	ORROX CORP	0	-0.080602	0.320135	-0.45864	1.05412	-0.08621	0.158806	0.78289	2.19368
148	POLAROID CORP	0	0.053906	0.028629	0.07299	0.03774	0.05364	0.046791	0.07823	0.44438
149	SPEED-O-PRINT BUS MACHINES	0	0.048622	0.028644			0.04424	0.118145	0.07417	0.58650
150	VISUAL GRAPHICS	0	0.053098	0.027816	0.11617	0.04769	0.03274	0.490694	0.19928	0.48995
151	GENCORP INC	1	0.045129	0.023273	0.07379	0.03879	0.04809	0.498496	0.12478	0.32176
152	GOODRICH (B F) CO	1	0.022531	0.017692	0.05326	0.04225	0.01728	0.015077	0.06594	0.26898
153	GOODYEAR TIRE & RUBBER CO	1	0.045631	0.009829	0.10313	0.01980	0.03099	0.431975	0.09922	0.32825
154	LTV CORP	1	0.017864	0.051937	0.09653	0.20648	0.00852	0.506479	0.09868	0.62183
155	BALL CORP	1	0.059885	0.005846	0.13545	0.01420	0.03718	0.053291	0.24064	0.34738
156	HARSCO CORP	1	0.082459	0.021094	0.14175	0.03385	0.05283	0.024894	0.14238	0.29951
157	HEXCEL CORP	1	0.051440	0.023304	0.11182	0.04063	0.03546	0.016058	0.30721	0.97568
158	PARKER-HANNIFIN CORP	1	0.074337	0.014540	0.13880	0.02978	0.05053	0.014032	0.13701	0.32054
159	BUCYRUS-ERIE CO	1	0.036435	0.101227	0.07043	0.20931	0.05060	0.038459	0.13658	0.41445
160	EAGLE-PICHER INDS	1	0.070623	0.023974	0.12134	0.04040	0.04369	0.013135	0.15744	0.38348
161	UNIDYNAMICS CORP	1	0.047799	0.022436	0.09782	0.04046	0.03468	0.415042	0.09892	0.35174
162	CONRAC CORP	1	0.045143	0.025478	0.09854	0.05475	0.04023	0.011513	0.17024	0.59024
163	EMERSON ELECTRIC CO	1	0.119313	0.007056	0.18350	0.01222	0.07844	0.091988	0.13824	0.22193
164	WESTINGHOUSE ELECTRIC CORP	1	0.041592	0.022222			0.03618	0.355699	0.12477	0.33059
165	RCA CORP	1	0.031993	0.016084	0.12041	0.05451	0.02821	0.487353	0.08644	0.35721
166	ITT CORP	1			0.10868	0.00192	0.04349	0.005306	0.09254	0.31632
167	EDO CORP	1	0.041608	0.032864	0.07768	0.08071	0.04298	0.455475	0.28741	0.72240
168	MOTOROLA INC	1	0.071621	0.011626	0.12839	0.02356	0.05395	0.012358	0.11976	0.34944

OBS	NAME	DI	MRTASS	SDASS	MRTEQ	SDEQ	MRTSLS	SDSLS	MMKT	SDMKT
169	VARIAN ASSOCIATES INC	1	0.041823	0.0269721	0.08010	0.04722	0.036243	0.013009	0.144435	0.51410
170	FORD MOTOR CO	1	0.025581	0.0543243	0.05302	0.14946	0.012451	0.034613	0.147655	0.41309
171	GENERAL MOTORS CORP	1	0.047473	0.0544748	0.11638	0.04784	0.034471	0.462926	0.094922	0.32996
172	PACCAR INC	1	0.105455	0.0424813	0.15014	0.06874	0.043518	0.051114	0.278882	0.49388
173	ARVIN INDUSTRIES INC	1	0.053800	0.0318102	0.10930	0.04531	0.034114	0.038520	0.196764	0.45214
174	CURTISS-WRIGHT CORP	1	0.101739	0.0848863			0.181005	0.411581	0.184833	0.56401
175	UNITED TECHNOLOGIES CORP	1	0.057390	0.0069368	0.13414	0.01011	0.034036	0.180042	0.124621	0.33314
176	CESSNA AIRCRAFT CO	1	0.049080	0.0443273	0.10544	0.08162	0.032657	0.080933	0.120898	0.32940
177	GATES LEARJET CORP	1	0.075700	0.0380238	0.18170	0.08511	0.043731	0.486833	0.241478	0.83974
178	TEXTRON INC	1	0.062657	0.0205967	0.11488	0.04238	0.042622	0.341009	0.125811	0.36018
179	LEAR SIEGLER INC	1	0.072223	0.0125330	0.14356	0.03049	0.042846	0.060553	0.287629	0.51661
180	EASTMAN KODAK CO	1	0.117116	0.0249305	0.16343	0.03445	0.114326	0.034751	0.881814	0.30306
181	XEROX CORP	1	0.069648	0.0134515	0.14416	0.02511	0.047563	0.406158	0.036765	0.27482
182	TRANSTECHNOLOGY CORP	2	0.068782	0.0189309	0.17244	0.03339	0.052494	0.028458	0.431844	0.72247
183	TELEDYNE INC	2	0.115774	0.0465241	0.21452	0.08237	0.093157	0.408695	0.392534	0.81094
184	GENERAL ELECTRIC CO	2	0.078786	0.0071512	0.17799	0.01179	0.041158	0.451370	0.103067	0.24279
185	LITTON INDUSTRIES INC	2	0.077023	0.0124750	0.18766	0.04888	0.073982	0.476855	0.169906	0.62397
186	TRACOR INC	2	0.076310	0.0042830	0.17607	0.02556	0.044913	0.424920	0.332444	0.81028
187	SINGER CO	2	0.087981	0.0370404	0.02038	0.13587	0.004586	0.013961	0.069708	0.40431
188	CUBIC CORP	2	0.087473	0.0131700	0.14436	0.04327	0.047347	0.475010	0.241596	0.57748
189	HARRIS CORP	2	0.067183	0.0239996	0.14657	0.05420	0.044911	0.151688	0.181891	0.53326
190	LORAL CORP	2	0.091180	0.0125874	0.18498	0.04851	0.075989	0.486466	0.323243	0.80076
191	RAYTHEON CO	2	0.080593	0.0126724	0.18782	0.02588	0.047524	0.012998	0.197982	0.38378
192	SPARTON CORP	2	0.093819	0.0365591	0.14874	0.04934	0.053371	0.481138	0.247478	0.49434
193	TRW INC	2	0.066559	0.0069572	0.14976	0.01415	0.041653	0.079159	0.163115	0.42934
194	UNITED INDUSTRIAL CORP	2	0.087845	0.0086224	0.19149	0.02213	0.051759	0.079875	0.254237	0.54390
195	SUNDSTRAND CORP	2	0.070624	0.0247700	0.15582	0.03868	0.062938	0.431021	0.240858	0.58504
196	BOEING CO	2	0.071712	0.0149283	0.15435	0.07450	0.040856	0.476148	0.224486	0.53238
197	FAIRCHILD INDUSTRIES INC	2	0.062142	0.0321440	0.19981	0.09175	0.040312	0.416383	0.183428	0.46250
198	MCDONNELL DOUGLAS CORP	2	0.047993	0.0074437	0.12029	0.01654	0.031406	0.492259	0.180721	0.44716
199	INTL CONTROLS CORP	2	0.105912	0.0401059	0.23569	0.10883	0.076467	0.013599	0.466935	0.67074
200	ROHR INDUSTRIES	2	0.047485	0.0349118	0.15626	0.08624	0.030139	0.421952	0.148614	0.55686
201	SIGNAL COS	2	0.057684	0.0293634	0.10784	0.05474	0.048243	0.499286	0.158863	0.34129
202	TRE CORP	2	0.083304	0.0511843	0.09514	0.10361	0.042030	0.441779	0.342130	0.68051
203	E-SYSTEMS INC	3	0.098170	0.0321744	0.17706	0.06266	0.041998	0.018359	0.340774	0.49587
204	HAZELTINE CORP	3	0.039644	0.0257148			0.038573	0.034579	0.317409	0.72922
205	SANDERS ASSOCIATES INC	3	0.079144	0.0649144	0.14300	0.14335	0.059723	0.387818	0.269355	0.68920
206	WATKINS-JOHNSON	3	0.070517	0.0238637	0.11672	0.03891	0.043177	0.029239	0.272491	0.66969
207	GENERAL DYNAMICS CORP	3	0.044129	0.0307410	0.13593	0.08539	0.032534	0.013335	0.193394	0.44605
208	GRUMMAN CORP	3	0.046390	0.0251291			0.021488	0.024604	0.114649	0.30023
209	NORTHROP CORP	3	0.044351	0.0307204	0.15565	0.07151	0.033051	0.296345	0.231235	0.36950
210	MOOG INC-CL A	3	0.041678	0.0190272	0.11712	0.06506	0.045595	0.089499	0.224757	0.64591
211	TODD SHIPYARDS CORP	3	0.071047	0.0357853	0.22833	0.18554	0.000436	0.485552	0.170473	0.39148
212	LOCKHEED CORP	3	0.021615	0.0761592	-0.14880	1.15392	0.011792	0.005349	0.159693	0.66091
213	MARTIN MARIETTA CORP	3	0.072247	0.0223660	0.15448	0.03371	0.041291	0.039224	0.174342	0.28350
214	ROCKWELL INTERNATIONAL CORP	3	0.058022	0.0157296	0.14336	0.03294	0.037926	0.008758	0.164959	0.33923
215	WHITEHALL CORP	3	0.092123	0.0534376	0.17937	0.08144	0.067691	0.079263	0.420080	1.02743

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Beginning in 1976, facilities capital became a determinant of price in contracts negotiated by the Department of Defense. Facilities capital became a determinant of profit in the weighted guidelines profit policy and, at the same time, an amount based on facilities capital became an allowable cost under Cost Accounting Standard 414. This report presents results of an investigation into the role and effectiveness of facilities capital as a factor in contract pricing.

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20. (Continued)

A statistical analysis was first conducted to ascertain whether negotiated contract prices reflect the amount of facilities capital employed. Regression techniques are applied to a large data base of contracts negotiated between 1980 and 1982. In addition to testing the sensitivity of pricing to facilities capital, other factors such as the composition of costs, size of the award, Military Service, and type of contract were tested as determinants of price.

The response by defense contractors to the investment incentives of the revised pricing policy was then determined. The behavior of facilities capital in relation to the business base was examined, using a sample of defense-oriented business units. Defense contractor behavior was compared to durable goods manufacturers in general, and to defense contractors' own past behavior.

A model of contract pricing was developed to evaluate the effectiveness of alternative policies to encourage cost-reducing investments. The model is based on discounted cash flow analysis and was used to evaluate profit policies, depreciation practices, and contract cost incentives.

Finally, in a separate analysis, a comparative evaluation of the financial riskiness of defense companies and firms serving commercial markets was conducted. This evaluation was based on standard measures of financial risk and return, using balance sheet accounting concepts and market measures.

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